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THE OLD GUARD IN ENERGY TRANSMISSION.

Our readers will be interested in an account elsewhere in this issue of the present state of electrical energy transmission in Southern California. To the engineer the development is of particular interest on account of its completeness in covering the territory, the elaborateness of the network including both steam and electric stations, and finally, because it is the oldest development in the country in its inception and in its development. The very first high-voltage plant in the country, from the mountains back of Pomona and San Bernardino, was put into operation about 17 years ago. It was a little single-phase affair, but worked at the voltage, then unprecedented in America, of 10,000, obtained from a long line of twenty 500-volt transformers with their coils in series. In 1893 the first commercial three-phase transmission appeared in the same territory in the Mill Creek development No. 1. The hydraulic equipment of this plant has been somewhat changed by the use of a head higher than the original one, but it is interesting to note that some of the original 250-kw generators installed more than 16 years ago are still doing good service. This pioneer plant also, through its being the basis of early and important extensions, set the frequency of 50 cycles per second, which has been used throughout the whole great Southern California network. It is the only large system at this frequency in the United States, although this particular figure is the standard in European practice. A little later the Santa Ana Canyon plant, transmitting energy into Los Angeles, formed the basis of the immense network of the Southern California Edison Company, which has grown until it reaches from Redlands to the sea and now includes a great transmission system extending from the Kern River, far to the northward, into Los Angeles, 122 miles. This system covers the valley from Redlands to the Pacific very thoroughly. It includes seven hydraulic and four steam stations, at times all operated in parallel, although of late the Kern River plant with the Los Angeles steam plants have furnished most of the energy in that city. It is to be noted that when everything is in parallel the operation has been found to be particularly satisfactory, the long lines and transforming stations serving as buffers, so that plants of very varied character can be operated in multiple with entire success.

Second only to the system of the Southern California Edison Company is that of the Pacific Light & Power Company, which covers particularly the territory between Los Angeles and the sea. As in the other network, the principal station is on the Kern River, the distance between the power plant at Borel and the Los Angeles receiving station being 127 miles. This is a 66,000-volt installation. The Pacific Light & Power Company has four other hydraulic plants and three steam generating stations, of which the most interesting is the steam-driven station at Redondo, which contains three 5000-kw, 18,000-volt, 50-cycle, direct-coupled units. This plant, which is the main generating station for the Los Angeles Railway Company and the Pacific Electric Railway Company, uses crude oil

as fuel, as do the other steam stations in this territory. In this network, one again finds the utmost freedom in multiple operation, experience showing here as well as elsewhere that in working on a large scale over long lines there is not any material difficulty in such operation. In the early days of energy transmission there was some hesitancy in even operating water-driven machines in multiple, which was done commercially for the first time in the old Redlands plant.

A glance at the maps accompanying the article will show the thoroughness with which these two systems supply energy to the great central valley of Southern California for lamps and motors. Hardly any region in the country is so completely served, for the branch lines run to little towns and villages, to small industrial plants; every place, in fact, where a suitable market can be found. The lines of the Pacific Light & Power Company reach outward as far as Mentone, covering practically all the territory not already thoroughly supplied by the network. We have seen no accurate estimate of the areas served, but the combined systems must cover more than 2000 square miles, to say nothing of the long reach northward in the Kern River country. To obtain the necessary hydraulic power, the utilization of some of the existing irrigation plants has been necessary, so that a continuous flow of water has to be kept up somewhat irrespective of load. The ordinary wheel governing by deflecting nozzles takes care of this necessity, so that the water does double service. The industrial work done by these transmissions is of very important character and shows particularly on the load curve given in the paper. On the Edison system the 24-hour industrial load forms about one-third of the maximum load and the average load for the 24 hours is between 50 and 60 per cent of the peak, an unusually favorable condition.

Central-Station Power for Traction Service.

For some years there has been a marked tendency toward the wholesale manufacture of electrical energy in a central steam plant for distribution throughout a district formerly supplied by a number of local central-station plants, an idea doubtless rendered familiar by the development of hydroelectric transmission systems. There does not, in fact, appear to be any reason why in time electrical generation by steam plants should not, as in many cases of hydroelectric generation, become recognized as an entirely separate undertaking, having no connection as a business with the utilization of the energy developed, which would be supplied in wholesale quantities for any desired use, either at a standard voltage or in a converted form for lighting, traction and other purposes. Elsewhere are accounts of two recent interesting and important proposals having a bearing on this subject. These are the proposal of Mr. Samuel Insull to supply electrical energy from the central-station plant of his companies for the proposed electrified Chicago railroad terminals, and the similar offer of the New York Edison Company to relieve New York City of the expense of erecting generating plants for the operation of subways for which plans have been completed. While the subway electrical proposition may be considered in the light of an innovation by the New York public, the case is different in Chicago, where the central-station company already supplies electrical energy to one of the elevated roads and to both of the large urban street-railway systems. Undoubtedly among the factors that have influenced railroad men in their opposition to the electrification of terminals have been the large and uncertain investment for generating plant, distributing and transforming system, and the anticipation of perplexing technical detail connected therewith, both initially and under operation. The proposal of Mr. Insull puts an entirely different aspect on the question, and will doubtless clarify a situation which is now engaging lively attention in Chicago. The definiteness of both offers should also set the New York Central and electric traction interests generally in New York City to work thinking on the desirability of their going out of the electrical generation business and effecting an arrangement whereby the present central-station interest would take over their power houses and then supply them with traction power on a contract basis. Owing to the influence of diversity factors in such a combined system and the smaller expense of administration, etc., the economies possible should result in reduced cost of operation of the traction properties, and in lower cost of energy for light and stationary motors.

The N. E. L. A. Accounting Committee.

Under the form of organization which is open for the continuance of the work of the accounting section of the National Electric Light Association during the year, the committee on accounting has proceeded to take action that should make its efforts effective and contribute to permanent results in behalf of the member companies. As stated in our issue of last week, the committee has been organized into three active sub-committes to take up, respectively, the accounting problems indicated by the subjects of forms, public relations and uniformity of accounting practices. The work which lies before these sub-committees is indicated with sufficient clearness in their titles, and if they fulfill the objects of their creation, a long step forward will have been taken toward making the proceedings of the next annual meeting of this section so important that there will be no argument on the subject of adequate recognition for the accountants. One of the important matters which may be investigated with advantage under this form of organization is the extent to which uniformity in accounting methods prevails among the electrical corporations of the country. As the situation exists at present, no determined effort is made in many localities to follow accounting practices that are in accord with the latest recommendations of the association. Until within a few years, uniformity has not been prescribed by statute for many properties except in Massachusetts. However, the situation in this respect, notably in the States of New York and Wisconsin, has undergone a material change and assumed an importance that was not considered likely until the actual passage of acts conferring broad powers upon public-utility commissions. Eventually, more communities will prescribe a form of accounts for electrical corporations and it is highly desirable that methods that are as nearly uniform as possible should prevail among the companies. If an acceptable uniform system prevails, commissions that may be constituted hereafter with power to prescribe accounts will be more likely to adopt, or use as a basis, the uniform classification which they find in the district over which their jurisdiction extends. The accounting committee will have a difficult task before it in its endeavor to bring about the adoption of a uniform system, but the arguments which it can advance are so strong that it should receive support and co-operation from all companies whose operations are sufficiently large to render advisable the adoption of a system in the detail recommended.

Calculation of Transmission Lines.

We print an interesting article this week, by Mr. J. E. Dalemont, on the calculation of transmission lines, it being assumed that the lines are so short that their capacity may be safely omitted from consideration, and consequently that the effects of distributed capacity are still more negligible. Within these limits the method of computation described is swift and convenient. It is well worthy of study by transmission engineers in regard to its form. Of course, the substance of the method is necessarily presented in any method which engineers now use to predetermine the size of transmission line wires or to present the conditions of voltage at the two ends of a line already erected under varying conditions of load. Different engineers employ different methods of arriving at the required results. The relative merits of these different methods lie in their comparative simplicity, convenience and perspicuity. While calling attention to the advantages of the method presented in Mr. Dalemont's article, it is also fair to criticise a matter of detail in the terminology employed. We offer this criticism not in any captious attitude, nor merely as a matter of principle in terminology, but mainly because we think the reasoning is obscured by the use of the terms referred to. From our standpoint, the demonstration of the method would be simplified and clarified by the amendment here suggested, although we should be glad to see the matter discussed on both sides.

The gist of the method set forth in the article consists in treating the load at the delivery end of the line as an impedance per mile of distance. The impedance per mile presented by the line at the generating end is then the sum of the load impedance per mile and the line-wire impedance per mile. That is, the diagram in the article is essentially a linear impedance diagram, containing linear resistance for its horizontals, linear reactances for its verticals and linear impedances for its hypothenuses. Now, the linear properties of the transmission line r, x and z are described and shown as linear resistance, reactance and impedance respectively; whereas the corresponding quantities of the load, as presented at either end of the line, are described and shown as voltages, a use of language which is neither precise nor facilitating. A voltage divided by a line length and by a current is no longer a voltage, but becomes a linear impedance. Once the diagram is recognized as a pure-impedance diagram the advantages of the method in convenience and directness are immediately realized. If the diagram be regarded as multiplied by line current then all its lines become linear voltages. But it is illogical to consider part of the diagram as linear impedances and the remainder as linear voltages.

Counter Electromotive Force in the Electric Arc.

Considering the large number of arc lamps that are in nightly operation all over the world, the countless measurements of voltage and current that have been made on them, the number of years during which such observations have been accumulated, and the number of trained observers who have carefully studied arc phenomena, it is wonderful how much disagreement has existed upon certain properties of an arc that at first sight appear very simple. Reference may be made, in particular, to the questions of what are the resistance and the c. e.m.f. of an ordinary voltaic arc burning in air between a pair of opposed solid carbons? Various answers have been offered to this inquiry, at different times, by different skilled observers. A large part of the inconsistency between these answers is due to differences in the use of terms. Concerning the actual facts there is a greatly reduced margin of disagreement. An interesting article, by Prof. C. D. Child, on this subject has recently appeared in the *Physical Review*. The article shows that at least four different meanings have been employed, by different writers, for the term "resistance" of the arc, and that more than one meaning has likewise attached to the term "c. e.m.f." of the arc. The article should be read by all who desire to be familiar with the results of investigation in this branch of physics and engineering. It effectively sums up and enumerates the various researches on the subject. We can only touch one surface of the matter in this brief discussion.

If we send a direct current steadily through an electrolytic cell, we may observe the current strength with an ammeter, and the terminal voltage across the cell with a voltmeter. We might properly call the ratio of the volts to the amperes the apparent resistance in ohms of the cell. In general, however, we prefer to regard the terminal voltage as made up, in part, of a c. e.m.f. at the electrodes, and in remainder of a drop of potential in resistance within the electrolyte. This is particularly the case when dealing with storage cells. When charging a storage cell with 20 amp. at a terminal pressure of, say, 2.6 volts, we might speak of the cell as having an apparent resistance of 0.13 ohm, but it is usual to say that the cell offers a c. e.m.f. of 2.5 volts, and an internal resistance of 0.005 ohm. The reasons for preferring the latter, and seemingly more complex, mode of expressing the facts, is that if the charging current is shut off we still find a residual e.m.f. of 2.5 volts in the cell, and, moreover, if we vary the distance between the plates of the cell we find that the internal resistance of 0.005 ohm varies substantially in proportion to this distance.

In the case of a carbon arc burning in air we may have, say, 10 amp and 50 volts across the terminals. We may correctly state that the apparent resistance of the arc is then 5 ohms. But if the length of the arc be varied, at constant current, and the corresponding change in voltage be examined, we find that perhaps 28 volts are indicated across the very shortest arc that can be produced, and that the remaining 22 volts appears to be an IR drop varying substantially with the arc length. Some express these facts by saying that the arc has a c. e.m.f. of 28 volts, and a resistance of 2.2 ohms. But if the current is suddenly shut off the arc there is no such residual e.m.f. as 28 volts. There may be a small residual e.m.f. of less than 1 volt, but some observers have reported none at all, even when the current was very quickly shut off. It seems, then, improper to call the 28 volts that do not depend upon the arc length a c. e.m.f. A true c. e.m.f. should persist. It seems proper to regard this as an IR drop, localized in a very thin layer at the surfaces of the electrodes, the layers offering together a resistance of nearly 2.8 ohms. We conclude then that an ordinary arc offers a certain resistance in the column of hot vapor and also certain resistances at the anode and cathode surfaces. The arc only offers a small c. e.m.f. of about 0.6 volt, which is of thermoelectric origin, and which depends upon the temperatures of the carbons.

Offer of New York Edison Electric Power for New Subways.

The New York Edison Company has made a formal offer to the New York City Public Service Commission for the supply of electric power for the proposed new Broadway-Lexington Avenue subway and other subways and connecting lines to be constructed or already constructed, but for which no arrangements for operation have yet been made. The Edison company requests an opportunity at the proper time to present bids for the supply of electrical energy for the lighting of the subways and tunnels and also for the supply of electric power necessary for the operation of the cars and trains, and asks that where specifications provide for the construction of a power plant they be so drawn that they will also permit the contractor, who may assume the operation of the subways, to propose an alternative arrangement under which he may obtain the supply of power from a properly equipped electricity supply company. If it should appear to be to the advantage of the city and the operators of the subways or tunnels to purchase power for lighting and traction in preference to making the large investment necessary for the construction and operation of a special generating plant exclusively for that purpose, the contractor, it believes, should have the option of providing for the necessary energy by contract with a company in the business of supplying electricity for lighting and power.

The communication to the commission states that the generating plants of the Edison company are of large capacity, provided with adequate reserve in every part and equipped with the latest and most improved types of apparatus for the economical generation of electrical energy. The company is prepared to supply any lighting or power service, existing or prospective, for street railways, subways or other means or transportation, however extensive the service may be.

With the already large energy output from the existing plants, the opportunity of taking advantage of the diversity factor in the demands for the various industries to which power is now being supplied, the considerable margin of capacity always available, and the possibility of providing a reserve held in common instead of its unnecessary multiplication, should, it believes, place the company in a position to provide adequate power supply under most advantageous terms, reducing to a large extent the investment which would have to be made for a special generating plant. It considers, therefore, that it will be found alike to the advantage of the city of New York and the contractors for the construction and operation of the subways and tunnels to contract for their power service rather than to make the large investment that may be necessary to provide a special power plant.

Case Involving Definition of Annual Horse-Power.

An interesting action was tried at Toronto before Justice Britton on Monday, Oct. 18, which involved an issue as to whether maximum or average horse-power was implied in a contract. The Attorney-General of Ontario, on behalf of the Queen Victoria Niagara Falls Park Commission, brought suit against the Canadian Niagara Power Company, that being the name of the company operating the power house of the Niagara Falls Power Company, on the Canadian side. The amount sued for is $15,217.97, and the claim is for rentals and payments on electrical horse-power generated by the Canadian company in excess of 10,000 hp per annum, during the period between Nov. 1, 1905, and May 1, 1908. If the suit is decided in favor of the Park Commission, the commission will continue to collect future rentals on the basis of the claim advanced at the trial of the suit.

After all of the arguments of counsel had been submitted, the judge stated that "most of the difficulty appears to be in the fact that words of a technical character have not been used in their strictest sense. For instance, horse-power and power are not the same, and yet they are used practically interchangeably in the agreement. If this were a dispute between two private parties I would have no hesitation in deciding it now, but considering the importance of it, I shall reserve judgment."

The Park Commission claimed, under the agreement, that for any amount of power generated up to 10,000 hp $15,000 per annum was to be paid; for between 10,000 hp and 20,000 hp $1 per horse-power extra; for between 20,000 hp and 30,000 hp 75 cents per horse-power, and for over 30,000 hp 50 cents per horse-power was to be paid each year. The plaintiffs claim, under the agreement, to be entitled to collect $23,716.65.

The defendants, the Canadian Niagara Power Company, contended that the agreement states it should pay but $8,700.26, and this sum has been paid without prejudice. The attorney-general, for the commission, therefore sued for the remaining sum, with interest, which totals $15,217.97. The company's counsel argued that they were under agreement to pay rental for the amount of power used and sold, and not the amount generated. They had generated on some days much more power than they had on other days, and did not consider that they should be charged for the maximum generation all the year through.

New Orleans Electricians' Licensing Law Declared Unconstitutional.

The Supreme Court of the State of Louisiana, one judge dissenting, has pronounced unconstitutional, in a case appealed from the Criminal District Court for the Parish of Orleans, the act (known as the New Orleans Electricians' License Law) on the grounds that it is in violation of the Fourteenth Amendment of the Constitution of the United States. The decision practically declares that the exemption of railways and lighting companies, and the Department of Police and Public Buildings from the provisions of the act, constituted class legislation.

It is not anticipated that the Board of Electrical Examiners and Supervisors will ask for a rehearing from the Supreme Court, as the language of the decision is vigorous and unmistakable in its position. It is possible that another act may be brought before the Legislature next May, which, however, could hardly become operative before September following.

Massachusetts Commission Rules Against Reduced Electric Rates for Boston School Houses.

The Massachusetts Gas and Electric Light Commission has issued an important ruling in the form of a letter to Mr. George E. Brock, acting chairman of the Boston School Committee, relative to the rates for electrical energy supplied to the buildings of the city of Boston under the custody of the committee. During the summer this committee requested the board to consider the question of school-house rates, with the hope of securing a reduction for this service, which is furnished by the Edison Electric Illuminating Company of Boston. The committee urged that the city is entitled to a lower rate than is charged other customers of the company; that the price should be reduced in proportion to the cost of producing electricity; that the school committee is a large consumer of electricity and hence should enjoy a lower rate than ordinary customers of the company; that it costs less to supply electricity to the city than to ordinary customers of the company; and that as the demand upon the company does not come at the time of the peak load the city should enjoy a more favorable rate than the company's ordinary customers. Data were also submitted to show that other cities of the State and country obtain electricity for public buildings at considerably less than is charged other customers under like conditions.

The board states that the issue is of too far-reaching importance to be answered solely with respect to the interests represented by the committee, and says in part:

"It may be conceded that reductions in the cost of supplying electricity should be followed by reductions in price. But that is not the real issue presented—it is rather that the board shall now recommend that the company shall discriminate in favor of the city over all its other customers. The board believes that such discrimination cannot be seriously urged on the ground of any substantial difference in cost. The two items of advertising and collection mentioned form so trivial a part of the cost of supplying electricity (probably not over a small fraction of a cent per kw-hour sold) as to be negligible. The board also believes that a discrimination cannot be properly based on the school committee being 'a very desirable customer of the company because of the hours during which its buildings consume current.' Other customers are equally desirable for the same reason, and no discrimination can fairly be based on this ground, which does not apply to all customers in a similar situation as well as to the city.

"The board is unable to adopt the suggestion that the school committee as a large consumer is entitled to a discrimination. The board has had repeated occasion to say to companies that discriminations in prices based solely on the amount consumed by different customers are not justifiable. It is an open question whether the school committee is, according to the common acceptance of the term, a 'large consumer' of electricity. The aggregate consumed in all the buildings under the committtee's care is large, but the amount consumed per building is small, and, as a rule, the buildings are widely scattered, and are, and must of necessity be, independently supplied. It would hardly be claimed that a private owner of similarly located buildings is entitled to different treatment solely because the aggregate of all his bills is large.

"The board recognizes the weight commonly given to the argument that the company enjoys valuable privileges in the public streets granted to it by the city and that in consideration therefor the company should make concessions to the municipality as a customer. Municipal officers in making such grants are not acting as the agents of the city, but as public officers designated by the Legislature for that purpose. The streets are laid out to serve the general public convenience and this applies not only to travel over their surface, but to their use for the supply of water, light and sewers. The fact that the power to locate public ways is to a considerable extent vested in municipal officers and that their construction and maintenance have to a large extent been imposed upon municipalities, gives to the municipalities or their inhabitants no peculiar privileges in such ways. The right to erect poles and wires in or under public streets cannot be properly granted for the private advantage of the company, but solely to serve the public convenience. Any attempt to charge for the use of the streets, either directly by some form of tax, or indirectly by a concession in price made to the municipality, is virtually an attempt to shift a portion of the burden of taxation from the taxpayer as such to the consumer of electricity as such. This is the fundamental question involved in the position taken by your committee.

"The board believes that in the absence of express legislative sanction, it is not within its province to put into effect by indirection a policy which the Legislature has repeatedly declined to endorse. For the reasons thus outlined the board is unable to require the company to make a discriminatory rate in favor of the city's buildings under your care. In the views now stated the company's general schedule is not involved. If your committee or other consumers of electricity believe that the present prices are too high, the board has ample jurisdiction upon formal complaint in the manner provided by statute to order a reduction. But until the board is convinced that its present position is erroneous, reductions in price must be ordered for the benefit of all customers and not for the benefit of any one customer, although that customer is a municipality. Notwithstanding the practice by many companies of making special concessions to municipalities, the board is of the opinion that such practice should be supported by stronger reasons than have yet been presented in order to justify its continuance."

Brailey Telephone Properties.

For the past week there have been conflicting rumors as to the probable disposition of the United States Telephone Company and the Cuyahoga Telephone Company, both of Cleveland, Ohio, the controlling interest in the properties having passed into the hands of Mr. James S. Brailey, Jr., for years one of the most prominent independent telephone men in the United States. A telegram from Toledo reported that the Bell people had acquired control through an option, not only of the two companies named, but also of the Home Telephone Company, of Toledo, the Indianapolis Telephone Company, of Indianapolis, and the long-distance lines of Indianapolis. Mr. Brailey has issued a statement which declares that there is absolutely no truth in the rumors that the Bell company has acquired an interest in any of the properties with which he is associated. He states that after two years' work he has completed financial arrangements for an interest in his various telephone properties, and since then has been arranging to buy additional securities for his syndicate. He is personally interested in this syndicate and expects to remain permanently one of the largest holders of independent telephone securities. He further stated that the United States Telephone Company is going ahead with its development work and is about to put up a new No. 8 copper circuit between Columbus and Toledo and between Columbus and London, and that he wanted every independent company and interest in Ohio to know that the United States Telephone Company would do everything in its power to protect their interests in the future the same as in the past.

Mr. Brailey expressed regret that a report that he had turned over the control of the independent companies to the Bell interests should have been given such wide publicity. He said he could account for the origin of the story in no other way than that he had been picking up the stock of the two companies in Toledo, Indianapolis and other places for his syndicate, and some of the newspaper men got the idea that it was for the purpose of turning it over to the Bell company.

Nothing new can be ascertained regarding the course that will be pursued by the Ohio Home Telephone Company, recently incorporated for the purpose of leasing the independent long-distance lines in Ohio. At the office of the United States Telephone Company it was said that the company is in a state of "suspended animation" for the present, and it is not known what will come of it. The step taken by the Brailey syndicate in securing a controlling interest in the stock of the two companies put a stop, temporarily at least, to further progress in the execution of the plans that had been mapped out for the new company. Mr. Brailey has given no hint of his intention regarding the leasing proposition, but still insists that the independent local companies will be protected and that their long-distance business will be taken care of by the United States Telephone Company.

Denials have been made by officials of all the companies included in the report coming from Toledo to the effect that the Bell interests are in control. The denials further state that there is no intention of turning the business over to any other companies or syndicates, and that it will be pushed just the same as in the past.

The Boston Electrical Show.

Active preparations are now under way to establish an electrical show in Boston next month which will surpass all previous enterprises of this kind in New England and compare most favorably with the exhibitions held in the other large centers of the country. The show will be held in the Mechanics' Building, on Huntington Avenue, from Nov. 15 to 25 inclusive, and the floor space is now practically all sold for the entire period. Upward of 100 exhibitors have signed contracts with Manager Chester I. Campbell, and an unusual diversity of appliances will be displayed. The General Electric, Westinghouse, Allis-Chalmers, and many other manufacturing companies have reserved prominent locations, and the representa-

tive supply houses of New England are preparing to show full lines of the latest apparatus and materials. Motor-driven machinery will predominate, and electric heating devices will receive special attention at the show. The exhibition is being held on unique lines, with a mutual co-operation plan in effect for the first time, by means of which any exhibitor who joins the association will participate in any profits of the show.

The illumination will be of the most elaborate character, about 100,000 incandescents or their equivalent being used. The artistic side of the decorations is being designed and executed under the plans of Mr. E. W. Campbell, architect, of the Atlantic Decorating Company, of Boston. The Edison Electric Illuminating Company of Boston has taken active interest in the exhibition from the start, and a large staff of the company's employees will be on hand to welcome visitors. A prominent location in the central hall has been secured by the company, and it will install a handsome Italian garden with electric illumination, electric fountains and booths for the special use of suburban patrons. There will also be public exhibitions of high-tension experiments and a prize contest for boys interested in electrical matters.

Alternating-Current Traction Replaced by Direct-Current System.

The Washington, Baltimore & Annapolis Railway will soon finish the work of changing its system from single-phase alternating-current to direct-current traction. Treasurer Gladfelter has stated that the change will effect an annual saving of $100,000 or more. Among reasons given for the change are that the use of the single-phase system prevented the company from availing itself of favorable opportunities for extending its traffic in Washington, and introduced complications at Annapolis and Baltimore. The voltage of the main line will be 1200, but in Baltimore and the District of Columbia operation will be at 600 volts.

Proposed Municipal Electrical Monopoly in Jamestown, N. Y.

Jamestown, N. Y., which has a Mayor who appears to be an enthusiastic advocate of municipal ownership and operation, has a municipal electric lighting plant, and there is also a central-station company, the Jamestown Lighting & Power Company, which has always had the larger portion of the commercial electric light and power business. The commercial business of this company is said to be nearly three times as large as that of the municipal plant. It is now proposed, however, that the city of Jamestown purchase the franchise and property of the Jamestown Light & Power Company for the sum of $90,000, which the central-station company, through H. P. Sheldon, its president, has said that it will accept, provided the purchase is consummated by Dec. 1, 1909. The owner of the Jamestown central-station plant is the United Electric Securities, of Boston, which has signified its willingness to accept the terms proposed.

For some time the Board of Electric Light Commissioners, operating the municipal plant, has been convinced that the two electric lighting plants represented a useless duplication of effort. In a communication to the Common Council of Jamestown, dated Oct. 14, the commissioners, with Mayor Carlson at the head, say that there is no more necessity for two electric light plants than there is for two water plants. Therefore, numerous conferences have been held, with the idea of arriving at an agreement by which the central-station property might be purchased by the city. A complete inventory was made of the company's property, the company being represented, of course, and the city being represented by the superintendent of the municipal plant, while as an arbitrator Mr. W. S. Barstow, of New York, was called in as an expert electrical engineer. The net footing arrived at for the visible assets was about $89,500. This did not represent anything for good will or franchise, and only $500 is added to cover this feature. The electric light commissioners have recommended that the purchase be made at the figure given, $90,000. Should the Common Council and taxpayers confirm this recommendation, it will be necessary to consolidate the two plants, and the further sum of $30,000 is estimated as necessary for this purpose, making a total of $120,000 needed to execute the plan. The board therefore recommends that a special election be held at an early date to vote upon the proposition to bond the city of Jamestown for the sum of $120,000, this sum to be applied to the purchase of the franchise and property of the central-station company and also for the combination of the two plants with necessary extensions. It is the desire of the commission that the taxpayers vote on the proposition on the regular election day next month. It is said that the net earning capacity of the two plants after consolidation will, at present rates, be 14 per cent on the investment after allowance has been made for interest on bonds and for depreciation.

Illinois Central Refuses to "Electrify" in Chicago.

Issue seems to be joined between the city of Chicago and the steam-railroad companies, particularly the Illinois Central, on the question of terminal electrification, as the result of the annual meeting of the Illinois Central Railroad Company on Oct. 20. At this meeting the stockholders of the company, on the recommendation of the directors, adopted the following self-explanatory resolutions:

"Whereas, In the report submitted by the president to the board of directors mention is made of the complete and exhaustive investigation into the subject of electrifying the Chicago terminals, and special attention is called to the suggestion from the city authorities that the local suburban service be electrified with a view to demonstrating the advisability and practicability of a further extension of the system to the balance of the terminals, and

"Whereas, The report of the experts who have been engaged in the study of the entire problem for the last year or more develops that, in view of the complications brought about by the necessity of providing for suburban and through passenger traffic, through freight, transfer and switching movements, as well as interchange between railroads which deliver business to our line in the Randolph Street yard, and the necessity for delivering a large part of our business into other railroad yards, via Sixteenth Street and Forty-third Street, electrification at this time is impracticable; hence the necessity of the greatest possible study in order that intelligent prudence shall form the basis for an expenditure of a large sum of money. The study and investigation up to this time have developed a decidedly complex situation, distinctly different from that which pertains wherever electrification has been applied, and

"Whereas, The general public is more concerned in the elimination of the smoke nuisance than it is in a change of motive power, and the interests of the public, as well as that of your stockholders, will be conserved by extending the use of coke or other smokeless fuel to engines on the Chicago terminals as rapidly as possible, therefore, be it

"*Resolved*, That this board feels the necessity for deferring a determination as to the electrification until such time as a continued study of the subject can intelligently determine the proper line of procedure."

In his special report to the directors, discussing the electrification problem, President Harahan, of the Illinois Central Company, gave four cardinal reasons why the road should not attempt to make this improvement at the present time. In brief these reasons may be stated as follows:

1. The art of electric traction has not progressed beyond the experimental stage sufficiently to justify the large expenditure necessary for its application on the company's Chicago terminals. It would be impracticable to operate the interchange of

freight traffic and switching movements with electric traction as developed at the present time.

2. The large expenditure necessary would involve fixed charges in excess of economy effected from electric operation.

3. Smoke may be eliminated by other means.

4. It would be inadvisable for any one railroad in Chicago to undertake electrification before a comprehensive plan has been developed in which all of the railroads may participate.

Mr. Harahan made the following financial statement of the results, applying to the year ended June 30, 1909, if the suburban service alone were electrified compared with the present steam operation:

Gross earnings		$1,056,446
Operating expenses (82.9%)	$872,307	
Taxes (7%)	74,427	
		946,734
Net revenue		$ 109,712

ESTIMATED RESULT UNDER ELECTRIFICATION.

Gross earnings		$1,056,446
Operating expenses (66%)	$697,254	
Taxes (7%)	74,427	
		771,681
Net revenue—Electric operation		$ 284,765
Net revenue—Steam operation		109,712
Increase		$ 175,053
Estimated cost of electrification of suburban service		$8,000,000
Interest at 5% per annum		400,000
Depreciation at 5% per annum		400,000
Total fixed charges account electrification		$ 800,000
Saving in operation under electrification		175,053
Amount loss in operation under electrification		$ 624,947

Electrical men will note with surprise that Mr. Harahan's estimate does not make any allowance for probable increase in gross receipts after electrification, owing to the greater attractiveness of the electric service. He also places the operating expenses under electricity at the rather high figure of 66 per cent of gross earnings.

In relation to the smoke nuisance, Mr. Harahan says that the company is experimenting with coke to replace soft coal on locomotives, and also that it is negotiating with a view of securing self-contained motor-cars, evidently referring to cars operated by gasoline engines, for use on the suburban lines.

In answer to this attitude of the railway company, the local transportation committee of the City Council has under consideration the draft of a mandatory ordinance to compel every railroad company in Chicago to operate its cars within certain limits prescribed by the ordinance after Jan. 1, 1912, by some other power than that of steam. The proposed ordinance provides that all railroad companies in the city shall within six months after its passage submit to the Commissioner of Public Works plans and specifications for the operation of their cars within the territory named by some power other than steam. If these plans are approved, the company must proceed with all reasonable haste to make the change. No company is to be allowed to operate its cars within six months after the passage of the ordinance within the limits mentioned, unless it shall have submitted the plans and specifications referred to. The limits of the territory to be covered by the provisions of the ordinance have not been determined, but it is expected that, in the case of the Illinois Central, they will be fixed at least as far south as Sixty-seventh Street. It is provided that any railroad company which shall violate any of the provisions of the ordinance shall be fined in a sum not exceeding $200 a day.

This measure is subject to modification, of course, and it is believed that the city will have to rely upon the police powers of the municipality in order to enforce it.

The newspapers have been interviewing the directors of the Illinois Central Railroad on the subject of electrification, and what Mr. Cornelius Vanderbilt, of New York, has to say on the subject is of particular interest. Mr. Vanderbilt is reported to have declared that the fact that the New York Central is operating passenger trains successfully in its New York terminal has no bearing on the situation in Chicago. "It is one thing to handle passenger trains by electricity where the tracks are comparatively simple and the trains light," Mr. Vanderbilt is reported to have said, "but an entirely different problem is presented in Chicago. A large proportion of our business in Chicago is interchanged; three other roads use our terminal regularly, and it would be impossible for us to electrify our tracks unless the other roads did the same. In time, perhaps, a plan might be worked out whereby the roads could all use electricity, but it would require years to accomplish. As it stands now, we do not know enough about the operation of trains by electricity."

General resentment is expressed on the part of the public toward the obdurate attitude of the railroad company, and it seems reasonably certain that the campaign to obtain the advantages of railroad electrification in Chicago will be maintained with vigor.

New York Edison Company Entertains Electrical Contractors.

The New York Edison Company entertained over 1000 electrical contractors at a smoker given in connection with the New York Electrical Show in Madison Square Garden on Oct. 19. The entertainment began with a series of motion pictures in the Concert Hall, followed by a vaudeville performance given by artists appearing in various music halls in New York during the week. Cigars and cigarettes were distributed, and by the time the excellent program was exhausted it was midnight. The Electrical Show being cleared of visitors, the arena was again lighted and the guests given the freedom of the Garden to inspect the exhibits. Meanwhile the arena platform was cleared, and by an ingenious use of the counter around the balcony, a dining table two blocks long was provided on which a midnight supper was served.

Inspection of Moving-Picture Shows.

In accordance with the opinion of the corporation counsel of Chicago, the duty of inspecting moving-picture shows in compliance with the terms of an ordinance adopted Feb. 1, 1909, falls on the Department of Electricity. There are 450 "nickel theaters" of this class in Chicago, and between Sept. 30, when Mr. William Carroll, city electrician, notified his inspectors of the decision of the corporation counsel, and Oct. 19, 200 inspections had been made. This prompt work on the part of the Department of Electricity revealed the fact that in most cases the ordinance is not being complied with, but the violations are not of such a serious nature as to require drastic action. Mr. Carroll is now sending a copy of the rules and regulations of his department referring to moving-picture machines to all owners of theaters of this class. He is also sending out a circular letter saying that the apparatus used must be made to comply with the ordinance within 10 days after receipt of the letter. As soon as the theater owners are notified arrangements have been made to inspect the premises once a month thereafter or at as frequent intervals as shall be found necessary to see that the appliances installed are maintained and used in such a manner as to insure safety.

The ordinance provides that the arc lamp used as a part of moving-picture machines must be constructed as provided in that part of the rules and regulations of the department applying to portable arc-lamp equipments in theaters. Rheostats also must conform to the rheostat requirements for theater arcs. There must be an automatic take-up for the film, and the doors and openings of the casing for this take-up must be kept closed while the machine is in operation. The use of motors for the operation of moving-picture machines is prohibited, although the take-up reel can be operated by motor if desired. Moving-picture machines must be placed in a fireproof housing. No person but the operator in charge shall be allowed in the lamp-room during the time the picture machine is in use. Before every performance the operator must examine the machine carefully and see that it is in a safe condition to operate. Other precautions of a non-electrical nature are enjoined, such as the prohibition of smoking in the moving-

picture-machine inclosure. Policemen are instructed to cooperate with the electrical inspectors in enforcing the terms of the ordinance.

Chicago Municipal Inspection of Electric Meters.

The committee on gas, oil and electric light of the City Council of Chicago has under consideration an ordinance providing for the inspection of electric meters which will probably be adopted by the aldermen when presented. A similar inspection of gas meters is now provided by law, and it is proposed to afford the same privilege to users of electric meters, although, as a matter of fact, there is very little complaint of the accuracy of electric meters on the part of consumers of electricity. The inspection is to be made under the supervision of the city electrician. If a patron of the central-station company feels that his meter is not registering properly, he may have the instrument inspected by the Department of Electricity by making a deposit covering the cost of inspection. If the meter is found correct, the customer will forfeit his deposit, but if it is found to favor the company the deposit will be returned to him and the company will be asked to pay the cost of making the inspection. There will probably be in the ordinance also an arrangement for the return of overcharges if any should be found as the result of meter inaccuracy. In practice, however, it is probable that even after the ordinance is adopted the city electrician will not be called on to make a great many inspections, for he will first ask the complaining customer to take up the matter with the company, and, judging by the experience of the past, in 9 cases out of 10 a satisfactory adjustment will be made between the company and the customer treating directly with each other.

Wisconsin Water-Powers.

The special committee on water-powers, forestry and drainage appointed last spring by the Wisconsin State Legislature has just made an inspection trip in northern Wisconsin. The committee visited Eagle River, Star Lake, Arbor Vitae and Trout Lake to look over the forest reserve lands between Trout Lake and Boulder and Island Lakes. The trip through the Manitowish chain of lakes was made in a launch. This chain, which is composed of Rest Lakes, Manitowish, Ashland, Duluth and Cass Lake, Minnesota, compose the principal reservoirs of the proposed Chippewa River Valley reservoir system. The committee returned by way of Chippewa Falls, where a close examination of the water-power of the Chippewa River was made. The members of the special committee are as follows: Senators H. F. Bird, Paul O. Husting, Henry Krumrey; Assemblymen William M. Bray, George P. Hambrecht, secretary, F. W. Kubasta and James E. Thomas.

A movement has been put on foot at Dolgeville, Wis., to establish a system of reservoirs and dams on the creeks in that region. Considerable horse-power can be developed in this way, and the electricity would readily be used by the mining camps.

Telephone Situation in Jamestown, N. Y.

One of the public-utility problems engaging the attention of the citizens of Jamestown, N. Y., is the status of the Independent telephone plant of the Home Telephone Company. This company has reached a stage where it wants permission to raise its rates or else have the city buy the whole outfit or permit it to sell out to the Bell Company. The Common Council at a meeting held nearly a month ago voted down a resolution to submit to the vote of the people the question of buying the plant for $286,000. Then the Chamber of Commerce called a public mass meeting to discuss the whole subject. The Home Company has refused to make extensions and the situation was so complicated that it was thought that a public meeting might in its wisdom devise some solution of the problem.

This meeting was duly held on Oct. 4, and Mayor Carlson made a speech favoring municipal ownership, recommending that the question be decided by a referendum, the vote to be upon all of the propositions under consideration. He said that the subscribers pay the entire expense of the telephone service, whether it is privately owned or publicly owned, and that municipal ownership would enable this service to be given to the users without the inclusion of dividends or profits, which would go to the private owners. An auditor who had examined the books of the Home Company said that the company's gross income in 1908 was $46,890 on an estimated average of 2587 telephones, being an average of about $18 per telephone. Deducting expenses and bond interest, the net profit was $2,050, from which to make extensions and provide for depreciation. This gentleman expressed the opinion that it would be unwise for the city to buy the plant.

The president of the Common Council said that the majority of the aldermen favored a raise in rates and competition in the telephone business. He recalled that the appearance of the Home Company in Jamestown had resulted in a reduction of telephone tolls. There was considerable discussion, in which the fact was brought out that there had been internal dissensions in the management of the Home Company. The question was also raised whether the city had any right to buy the plant under the State constitution.

At the conclusion of the mass meeting the Common Council held a meeting, and a resolution to submit to the taxpayers a proposition to buy the plant or secure bids for the construction of a duplicate plant at a cost not to exceed $315,000 was voted down by a vote of 8 to 3. It was decided to ask the corporation counsel to give an opinion on the legality of buying the plant, and this opinion was presented a week later. It was to the effect that the Council did not have a legal right to purchase the plant on the ground that it would be taxing all for the benefit of a few; further, the bonding limit of the city would be exceeded if the sum of $286,000 was added to the present debt.

In view of the opinion of the corporation counsel, the Common Council, on Oct. 11, by a vote of 7 to 4 decided to give the Home Telephone Company the authority to make the desired increase in rates. The resolution authorizes the company to increase its rates to a maximum of $36 per year for a single-party business telephone. The new rates decrease to $16 a year for a four-party residence telephone. Mayor Carlson vetoed this resolution, but before doing so he called another telephone mass-meeting in which the subject was again threshed over at considerable length. The point was made that the rates would have to be increased whether the plant was operated by the city or by private owners, but a motion was carried that it was the sense of the meeting that the Mayor should veto the resolution granting the increase in rates. The Mayor accordingly did so, but at a meeting of the Common Council on Oct. 18 the resolution permitting the increase in rates was carried over the Mayor's veto by a vote of 8 to 2. At this meeting the Mayor enlivened matters by apparently charging the general manager of the Home Telephone Company with bribery. This gentleman was present and denied the charge, and he asked the Common Council to make an investigation.

Sons of Jove Annual Meeting.

The seventh annual meeting of the Order of Rejuvenated Sons of Jove was held on Oct. 14 and 15, 1909, at Cleveland, Ohio. Headquarters were at the Hollenden Hotel, and about 175 Jovians attended.

The work on the first day was confined to the meeting of committees, and in the evening the Cleveland Jovians gave a theater party at Keith's Hippodrome. Friday, the 15th, was Jupiter's Day. In the morning a business session was held at the Hollenden. In the afternoon special cars carried the Jovians to the Euclid Garden Theater, where a class of nearly 100 candidates was initiated, one of the largest classes in the history of the order. The work of the Rejuvenation was ex-

emplified in full form by the Buffalo degree team in seven tableaux, with appropriate scenic setting and accessories. The floor work was in charge of Mr. Harry C. Rice, No. 376, of Cleveland, assisted by an Imp team of six Cleveland Jovians.

In the evening the Joviation dinner was held at the Hollenden Hotel. The toastmaster called upon the following Jovians, who responded briefly: Seventh Jupiter J. Robert Crouse, No. 260, of Cleveland; Past Jupiter William E. Robertson, No. 424, of Buffalo; Mr. P. Yensen, general manager Cleveland Telephone Company; Mr. E. H. Haughton, No. 278, of Chicago; Mr. H. E. Hackenberg, treasurer of the National Carbon Company, Cleveland; Mr. E. E. Noble, of the Cleveland Electric Illuminating Company; Mr. C. A. Parker, secretary Curtis Advertising Company, of Detroit, and Mr. J. W. Worbs, secretary-treasurer of the Adams-Bagnall Electric Company, Cleveland.

Following the dinner the entertainment committee, Mr. H. H. Cudmore, chairman, put on a very clever line of vaudeville. Before the Joviation ended a silent toast was drunk to Past Jupiters C. W. Hobson, No. 1, and C. A. Newning, No. 2, according to the Jovian custom. The nominating committee offered two tickets for election, resulting in the choice of Mr. Oscar C. Turner, No. 333, Life 3, of Warren, Ohio, as the reigning eighth Jupiter.

An interesting feafure of the convention was the election of Mr. Charles F. Brush, the well-known pioneer in the electric lighting field, as an honorary member of the order. The greatest enthusiasm was evoked by the announcement that Mr. Charles A. Coffin, president of the General Electric Company, had become a life member. Eight life members were elected, making a total membership in all classes of more than 2500 Jovians.

Von Bolton Tungsten-Lamp Filament.

A patent was issued Oct. 12 on a process for making tungsten filaments to Mr. Werner Von Bolton, of Charlottenburg, Germany, one of the inventors of the tantalum lamp. The invention consists in inserting a refractory metal powder (tungsten) in a tube of ductile metal, and subsequently working the tube and contents into a filamentary form. One of the claims covers exhausting the air from the tube of ductile metal, sealing its ends and subsequently working it and the enclosed metal into filamentary form; and a third claim provides for removing the tube after the metal has been drawn into filamentary form. It is stated that by this process it is easy to draw a body from an original length of a few centimeters and a diameter of some 5 mm or 10 mm into a fine wire only a fraction of a millimeter in diameter. The specification says that it is old to purify tungsten and draw it in filaments without the use of an outer shell. The present process, however, differs also from the old method in that the metal powder can be used without the previous formation of a homogeneous fused mass; and, furthermore, by the present process the difficulties which are encountered in the drawing of tungsten by the old method are avoided. The tube may be composed of a ductile metal, such as tantalum or iron, and finally removed by one of a number of chemical dissolving agents, since tungsten is very difficult to dissolve. If the shell consists of nickel, this metal can be removed by evaporation, as it evaporates considerably below the melting point of tungsten.

Barclay Stock-Ticker System.

A United States patent was issued Sept. 21 to Mr. J. C. Barclay, assistant general manager and electrical engineer of the Western Union Telegraph Company, on a printing-telegraph system of the stock-ticker class. The patent discloses several radical improvements over existing stock-ticker systems, and a wide range of application of the instrument. The present tickers print the characters on a paper tape, but the Barclay instrument prints them in lines on a message blank or a sheet of paper, as does an ordinary typewriter. The message blank lies flat, horizontally, in the machine, in direct view of the operator, the paper carriage being operated automatically. This feature renders the instrument available for commercial business. The printing characters are disposed on the face of a type wheel, which is rotated synchronously with the sunflower arm of the transmitter. A pause in the motion of the arm on any one of the segments of the sunflower causes the printing of the corresponding character on the typewheel. Only one class of signals is transmitted over the line, the various operations of the receiving apparatus being controlled by a "separator" relay. The relay is governed by a commutator which rotates with the typewheel, and the relay in turn controls sundry local circuits containing magnets which control the performance of such functions as shifting the typewheel, return of the paper carriage, feeding of the paper, etc., at the proper times.

An important feature of the system is that it can be operated over long lines, thus affording means of transmitting stock quotations direct from one city to another city over one wire.

Joint Institute and Western Society Meetings in Chicago.

A tentative program of papers to be presented at joint meetings of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, at the rooms of the latter in the Monadnock Building, Chicago, has been prepared, although the exact dates are not definitely fixed. The November meeting (probably on the 19th) will be addressed by Dr. C. P. Steinmetz. Other papers to be presented at the monthly meetings have been arranged as follows:

December, Low-Tension Street-Railway Feeder Systems, by Mr. R. H. Rice.—January, Recent Developments in the Automatic Telephone, by Mr. Lee Campbell.—February, Special Motor Controls, by Mr. C. A. Dresser.—March, Electrical Features of the Reclamation Service, by Mr. O. H. Ensign.—April, Some Proposed Improvements in Underground Conduit Construction, by Mr. E. N. Lake.—May, Depreciation and Reserve Funds for Electrical Properties, by Mr. W. B. Jackson.—June, Induction-Motor Phenomena, by Prof. John D. Nies.

Mr. Insull on the Sale of Electric Energy in Chicago.

The most successful meeting in the history of the Electric Club of Chicago was held on Oct. 20, when about 200 representative electrical men of that city were present to listen to an address by Mr. Samuel Insull, president of the Commonwealth Edison Company, on "The Sale and Distribution of Electric Energy in Chicago." The address followed the weekly luncheon of the club, and Mr. F. P. Vose, the president of the organization, presided at the speakers' table, with Mr. Insull on his right and Mr. B. E. Sunny, president of the Chicago Telephone Company, on his left. There were several out-of-town electrical men present, including Messrs. James I. Ayer, of Boston; M. S. Hart, of New Orleans; H. R. Sargent, of Schenectady, and W. K. Archbold, of Syracuse. Mr. Vose introduced the speaker of the occasion, and he took occasion to declare that Mr. Insull and Mr. Sunny were elected members of the club "on sight."

Mr. Insull's address, although brief, was very instructive and interesting. The speaker gave most of his hearers, electrical men though they were, a new conception of the magnitude and importance of the business of supplying electricity in a city like Chicago. He declared that the business of supplying electric service should be a monopoly business in each community served, and that if his company were secured from competition, say, by a public-service commission, he would be entirely willing to agree to a periodical five-year adjustment of rates and to make public to the fullest extent an exact statement of the

profits, so that all might see the small margin on which the business is conducted. Mr. Insull pointed out how the rates for electricity has steadily decreased in Chicago, with the growing volume of the business, and he said that he hoped to see these rates go down to a still lower point, although, of course, no man could foretell how low the rates might be made in the future or at what time it would be found possible to reduce them with safety. To show the volume of the business, the speaker made the striking statement that if his company could reduce its operating cost one-thousandth of a cent per kw-hour it would mean a saving of $4,500 a year.

Beginning by saying that Chicago is the market place of the richest producing valley in the world, Mr. Insull remarked that to assure its continued success and prosperity, not only were men needed—men possessing the characteristics that have made Chicago great—but these men must have at their disposal material advantages which are essential to the industrial, commercial and social life of a great city. Among these advantages the possibility of procuring cheap electric energy is most important.

All electrical men, whether in the service of the electricity supply company or in the service of manufacturing corporations

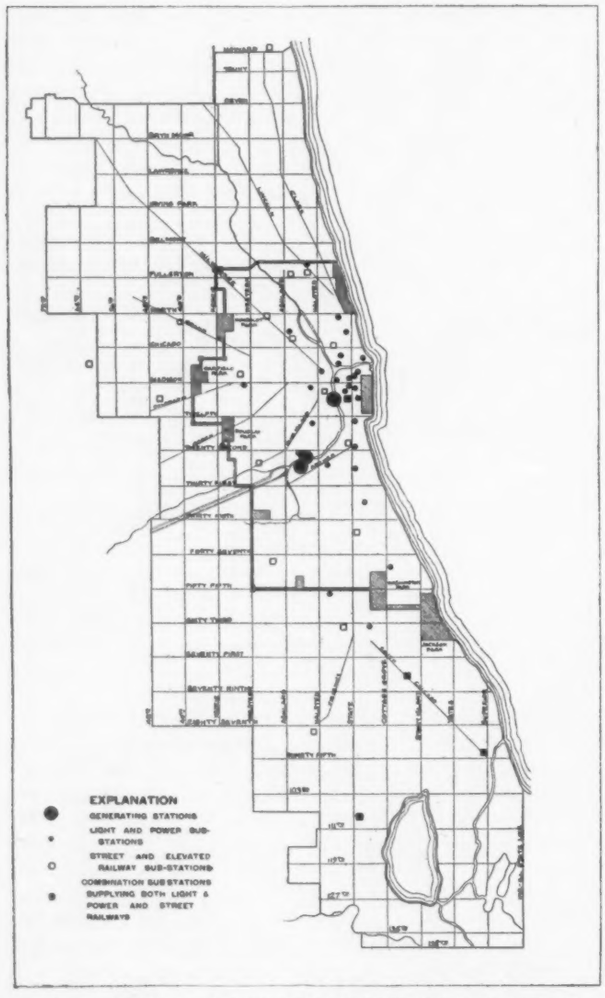

EXPLANATION
GENERATING STATIONS
LIGHT AND POWER SUB-STATIONS
STREET AND ELEVATED RAILWAY SUB-STATIONS
COMBINATION SUB STATIONS SUPPLYING BOTH LIGHT & POWER AND STREET RAILWAYS

FIG. 1.—OUTLINE MAP OF CHICAGO SHOWING LOCATIONS OF GENERATING AND SUBSTATIONS.

or engineers advising their clients, are equally interested in the development of electric service—in the distribution and sale of cheap electricity in the community.

The figures bearing on this business are very interesting. There is about $60,000,000 invested at the present time in the generation and distribution of electric energy from central stations within the corporate limits of Chicago. One may gain a better idea of what this means when he reflects that to pay 6 per cent interest on the money invested takes about $400 an hour, 24 hours a day and 365 days in the year. To enjoy the right to earn that interest the company has to pay, and does pay with pleasure, to the city and State an amount in taxes and compensation that exceeds $100 an hour. The total amount paid this year in taxes and compensation is about $900,000. It

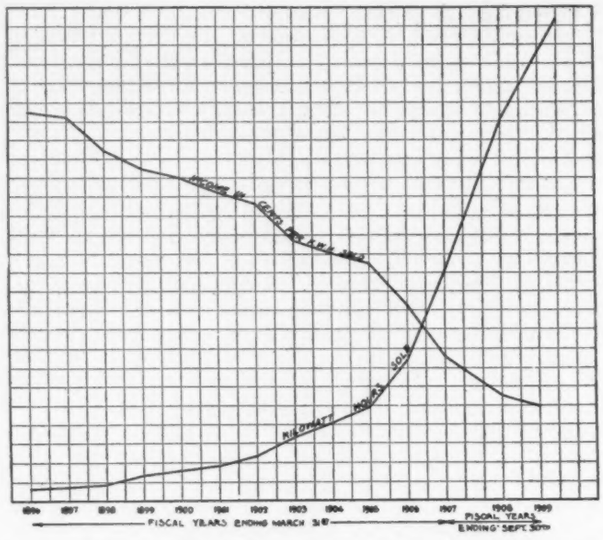

RECEIPTS IN CENTS PER K.W.H. SOLD
K.W.H. SOLD
1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909
FISCAL YEARS ENDING MARCH 31ST
FISCAL YEARS ENDING SEPT. 30TH

FIG. 2.—CURVES SHOWING DECREASE IN RATES AND INCREASE IN BUSINESS.

is a common thing for the newspapers in discussing public-service corporations to indulge in criticism relating to the alleged evasion of taxes on the part of these corporations. Mr. Insull asked his hearers to believe, in view of the statement he had just made, that such criticism did not apply to the company of which he has the honor to be the head.

It takes an average of more than 100 tons of coal an hour 8760 hours a year to produce the energy which the Commonwealth company sells. At certain times in the winter this coal must be burned at the rate of from 200 tons to 250 tons an hour. "Fancy," said Mr. Insull, "the engineering brainwork that must be centered in that one proposition—how to get through the grates 250 tons of coal in an hour. To take care of the business, to stand ready to deal with large and small consumers as they come along, we have at the present time a capacity of 240,000 hp, and during this coming winter the maximum load on our central stations will be upward of 200,000 hp. I do not know how much electricity is being generated by water-power plants at Niagara Falls, but I think the amount of electric energy we get from our steam plants here in Chicago will compare favorably with that produced by the great plants at the foot of Lake Erie."

Fifty-four stations and substations are needed to meet the various classes of business, from the smallest lighting installation to the operation of a railway system. These substations have a converting capacity of 275,000 hp, and the current that passes through them is conveyed by a total mileage of 1255 miles of cable, 400 miles of overhead wires and a conduit mileage of 2200. This development has taken place in less than 30 years, and in order to take care of the growth of the business the company is spending about $6,000,000 a year, or nearly $2,000 for every working day of the year. These figures give some idea of the investment side of the electric service business in Chicago.

Mr. Insull referred to the accompanying diagram to show that the kw-hours sold between 1896 and 1909 had multiplied 40 times, and here he remarked that the extent of the business was now such that the saving of one-thousandth of a cent in the unit of manufacture would amount to about $4,500 a year. Forming a striking comparison with the increase of the business is the decrease in average rates. This is shown by the

upper curve on the diagram. The company's income for the present year is only 25 per cent per unit sold of the income received in 1896. Of course, the gross income is much larger, but the curve shows the decrease of the average rate at which a kw-hour is sold. This marked decrease in rates has been accomplished by improved apparatus, concentration of production and some success in selling the greater volume of output.

The speaker referred to the sale of electricity as a monopoly business, and said that an isolated electric plant is as much of an anomaly as an isolated gas plant or an isolated water works would be. He contended that the day of the isolated plant has passed, and whether for supplying electricity to an office building or for the electrification of the terminal of a great railroad, there is no economical justification for the existence of such a plant.

"I wish to dwell upon this point," said Mr. Insull, "for the benefit of those of you who are not engaged in the manufacture of current. If you will bend your energies to the sale of current-consuming devices you can build up a business which has a permanency; if you bend your energies to competition with a power-generating company, I do not care in what city that company may be located, you are in the course of years doomed to failure. It is not among the possibilities in this day that electric current can be produced by small units in competition with the large production on a wholesale basis of the generating company."

Mr. Insull made the interesting statement that in looking over the field for his company in Chicago, as near as he could figure, the company is doing only about one-third of the possible business. This does not refer to the growth of the city, but simply to the possible electricity supply business in Chicago as it exists to-day. The speaker then called attention to a map of Chicago, also reproduced herewith, showing the generating and substations of the company, various symbols being used to distinguish the light and power substations from the railway substations and the combined light and power and railway substations. Beyond the city limits, too, electricity generated in Commonwealth stations is distributed as far north as Milwaukee on the north and Kankakee on the south, a distance of about 140 miles.

In closing, Mr. Insull emphasized the fact that the interests of all members of the Electric Club should be as one in extending the use of electricity. The producing company is engaged in an effort to produce the largest amount of electric energy at the lowest possible selling price. The claim is made for Chicago that it has the lowest selling price of any large electric supply company in the world. Taking the whole schedule of rates through, it is believed that electricity is sold cheaper in Chicago than anywhere else on either side of the Atlantic where energy is produced from steam-driven stations or even from water-power stations established as commercial propositions to make money. This fact should mean a great deal to those who represent manufacturing companies. If electricity is cheap there is, of course, a greater inducement to use current-consuming devices.

The cheap electricity available in Chicago should have an important bearing upon the agitation in relation to electrifying the terminals of the steam railroads. There are, of course, vast problems to be settled before this electrification can be accomplished, and it is well for all who are not steam-railroad men to treat these problems with respect. But so far as the current-producing side of the argument is concerned, it is a mistake to say that electrification is impossible because of the cost of electric energy. If this objection is based on a knowledge of the cost of electric energy used for the electrification of steam-railroad terminals around New York, it is based on false premises if it is contended that the same cost of electric energy must apply in Chicago. It is a fact that electric energy can be bought in Chicago considerably cheaper than it is now being produced by the two great traffic lines which are now engaged in electrifying their terminals in New York.

Mr. Insull said that he would be glad to answer any questions put to him, and when the applause following his address had subsided one visitor asked whether in case the railroad companies in Chicago should decide to electrify their terminals, using current purchased from the Edison company, it would be necessary for that company to build new generating stations to care for this demand. The answer of Mr. Insull was that his company could take care of any two railroad-terminal electrifications in Chicago, based on the present consumption of current by the roads running into the New York Central station in New York, with the present capacity of the Edison stations. With additional equipment, which has been ordered to go into service within a year, two additional terminals of like capacity could be served.

Mr. F. J. Holmes, of the Vulcan Electric Heating Company, asked how much of a factor in the growth of the business the placing of electric heating devices on the circuits of the company was proving to be. Mr. Insull responded that this was a difficult question to answer. He spoke, however, of the company's recent flatiron campaign, with which readers of these columns are familiar, but said that it would be difficult to trace exactly the amount of load due to electric heating appliances. He said that some years ago he tried to figure out the effect of fan motors on the business, but had to relinquish the idea of getting exact information, as anything like fan motors or electric heating appliances, that are more or less a matter of general daily use among the 70,000 or 80,000 customers of the company, are difficult to trace as a component part of the total load. The speaker added that he thought the reduction in the rates had had the effect of encouraging the use of heating devices.

Mr. J. W. Mabbs, superintendent of the Board of Trade Building, referring to the curve in the diagram showing the reduction in average rates, said that it would be interesting to have a curve of profits to compare with it. To this remark Mr. Insull made answer as noticed above, to the effect that if there were no danger from competition he would be glad to disclose in exact figures the profits of the company, showing the small margin remaining for this purpose.

Central-Station Economics.

The first meeting of the season of the Chicago Section of the American Institute of Electrical Engineers was a joint meeting with the Electrical Section of the Western Society of Engineers, and was held on Oct. 22. Mr. J. G. Wray, secretary of the local branch of the Institute, presided, and the speaker of the evening was Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, whose subject was "Central-Station Economics." By a coincidence the date of the meeting fell on a day when there was an unusually heavy demand for central-station service, the maximum load rate in the afternoon being 130,000 kw. The subject was, therefore, particularly timely.

Mr. Abbott spoke of the reduction in the selling price of electricity in the last 15 years, and said that radical changes which had been made in central-station economics have made this possible. He sketched briefly the development of the art of generating and distributing electric energy from central stations, and said that the great increase of business has made necessary large and specialized organizations and elaborate analyses of costs. Roughly, the revenue received by the large central station may be distributed as follows: Fixed charges, 50 per cent; general expenses, 20 per cent, and operating expenses, 30 per cent. Thus, the fixed charges equal the other two items combined, and the capital charge is the severest burden on the business and has the most to do in determining the selling price of electricity. In time the relative importance of the fixed charges will be lessened, and herein will lie the possibility of making material reductions in the selling price of electrical energy in the future.

Competition in the central-station business means a duplication of capitalization, and is an economic error. Where there is such competition the inevitable tendency is toward consolidation, and when this is effected the resulting monopoly is

loaded with duplicate investments on which fixed charges must be paid, and these fixed charges are paid by the consumer. It is apparent, therefore, that the business in any given community should be a monopoly. But it should be a regulated monopoly, protected against competition; the electric service company should be willing to accept fair regulation in rates and service as provided by the city or State.

In considering the matter of investment it must be remembered that the amount of money so expended must always be considerably in advance of the current demand to provide for the growth of the business. Furthermore, it is often necessary to expend large sums in building transmission or distribution lines through thinly settled areas, in order to reach some place of demand farther out. People in selecting their homes and factory locations in a large city and its environs give no thought to the matter of economical distribution from the central station.

The number of power houses to be erected depends on the extent of territory to be served, the density of population, whether the distribution is overhead or underground, and the permissible voltage. The cost of transmission lines, particularly if underground, has a material influence on the location of power houses. Thus, to transmit 50,000 kw for five miles underground at 900 volts may cost $2,500,000, and this large investment must be taken into consideration when the location of the generating station is considered. In case an ideal site for the power house can be obtained near the center of the territory served, there are advantages and economies in building a few large power houses rather than a number of small ones, but when this problem of the cost of transmission is also considered, it will be seen that a point is reached beyond which the concentration of generating equipment in the large power house becomes too great to be economical. In selecting the site for a power house arrangement must be made to have an ample area, an abundance of water for condensation and a location on one or more railroads supplying coal, unless access to the coal fields can be had by water transportation. When the requirements of the great power house of a large city are attentively considered it will be found that few suitable properties are obtainable, and the real-estate buyer for the central-station company has his troubles as well as the engineer who locates the station.

Fuel, next to fixed charges, constitutes the largest single item entering into the expense of producing electricity. The fuel question is a serious one, as it is by no means impossible that in the years to come there will be a scarcity of coal in this country owing to the enormous and increasing demand. Coal lands are being rapidly secured by railroads or by large holding corporations, and it is imperative that the large central-station company should make intelligent provision for its supply of coal for a long period of years ahead. An electricity producing company, such as that in Chicago, consumes the output of two or three fair-sized coal mines, so far as the particular grade of coal burned is concerned. However, these coal mines produce other grades of coal too expensive for power-house consumption, so that it is not desirable for the central-station company to mine its own coal unless it is prepared to dispose of the standard grades of fuel which it does not itself consume. It may be possible to combine with some railroad running through cheap coal lands by which the whole supply of mines may be taken, the railroad hauling the standard grades and disposing of them to other consumers.

In power-house design the controlling feature is the planning of the station in such a manner that the enormous quantities of coal passing through the boiler-room may be handled and burned cheaply. This implies, of course, suitable arrangements for the removal of the ashes. The advent of the automatic chain grate was a great step in advance in power-house construction. The automatic grate not only saves labor, but permits the boilers to be more efficiently and evenly fired and results in practically smokeless consumption of the coal. It is almost impossible to avoid smoke with hand firing.

Boilers are now worked to a much higher degree than formerly. It is very common to operate the boiler at 50 per cent above rating, and not infrequently at 100 per cent. It is found that this forcing does not hurt the boiler at all, but rather seems to add to its efficiency. In the very best practice 86 per cent of the potential heat energy of the coal is wasted in power houses; ordinarily 88 per cent is wasted, in spite of the most exacting and constant precautions to prevent waste of heat. Mr. Abbott then exhibited the following table compiled to show the losses made in converting fuel energy into electrical energy:

ONE POUND OF COAL = 10,000 B.T.U.

Ash pit	300	
Stack	1,960	
Banking fires	560	
Radiation and unaccounted for	800	
Total boiler-room loss		3,620
Rejected to condenser	4,810	
Pipe radiation, etc	370	
Total turbine-room loss		5.180
Delivered to busbars		1,200
		10,000

In discussing this table Mr. Abbott made the striking statement that one-fifth of the coal bill is paid just to produce a draft in the smokestack. Furthermore, 48 per cent of the heat of the coal is wasted in the condenser. This could be avoided if the condenser could be operated at something like minus 500 deg. Fahr., but, of course, this is impossible because in that case the station would be operating on ice and not on steam.

The speaker remarked that the fuel economy of gas engines is much greater than that of steam engines or even steam turbines, but, as a matter of fact, what is saved in fuel by the use of large sizes of gas engines is more than made up in the increased fixed charges, owing to the comparatively high price of these units. The steam turbine has enabled generators to be reduced in size and weight, while its efficiency is greater than that of the piston engine and its economy is practically constant over a wide range of load. Mr. Abbott gave the following interesting figures of comparison:

The steam engine of large size costs 10 cents a pound. A steam turbine of equal capacity costs 30 cents a pound. But the engine weighs 286 lb. per kilowatt, and the turbine weighs but 34 lb. per kilowatt; therefore, the turbine is much more economical. The generator of a turbine unit weighs 21 lb. per kilowatt, while the generator of a large engine unit weighs 80 lb. per kilowatt. The relative costs are approximately proportional to the weight. The foundations of an engine and generator set cost $3 a kilowatt, and the foundations of a turbogenerator cost 50 cents a kilowatt. In view of these facts, it is not at all strange, said the speaker, that turbines at once obtained complete mastery of the field in large power houses. Furthermore, turbines make possible the use of larger generators than ever before used. These machines are now made up to 14,000 kw, and within a few years there will probably be 25,000-kw units.

The difference in efficiency between engines and turbines is due to the fact that in large steam engines in ordinary practice the steam is expanded to about 25 times its original volume, whereas in the turbine it is possible to expand the steam to 700 times its original volume.

The economy of labor is also to be considered in comparing the turbine and engine. In the great modern power houses millions of dollars' worth of equipment are placed at the disposal of employees who often do their work at a distance of several miles from the administrative headquarters of the company. It is important that these men should be of high class and they should be generously rewarded for faithful work. The greatest of all extravagances of the central station is the loss due to shutdowns. Great diligence must be taken to guard against this possibility. A shutdown might be a veritable calamity, not only to the business of the company, but to the community which it serves. Money to insure against such a disaster is well expended; and this means not only that the help should be of high quality, but that there should be a merciless abandonment of inefficient apparatus.

Thirty per cent of the company's revenue goes for operating

expenses, and the speaker gave the following table to show how this money is spent:

DISTRIBUTION OF OPERATING COSTS.

	Per cent.	
Generating Costs:		
Operating payroll	6.1	
Fuel	20.8	
Supplies and repairs	4.8	
		31.7
Distributing Costs:		
Battery and substation operation and maintenance	12.1	
Street system maintenance	12.2	
Reading and maintenance of meters	6.8	
Free lamp renewals	16.6	
Free maintenance of other current-consuming apparatus	12.9	
Free wiring and free repairs on customers' premises	7.6	
		68.3
Total		100.0

It is interesting to observe that the free-lamp renewals cost as much as the expense for labor in all departments of the company, and four-fifths as much as the cost of the coal.

In the discussion, Mr. R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, reverted to the fallacy of competition, or, as he expressed it, the inevitable logic of centralization. The secret of the logic of this situation lies in the diversity factor, and Mr. Schuchardt showed how various classes of public service, as railways, power and lighting, do not make their maximum demands on the station at the same time. Furthermore, the reserve can be common to all and in this way the central station is enabled to effect marked economies. For instance, the Commonwealth company, by supplying large blocks of electrical energy to the railway companies, is enabled to make lower rates to the householders of Chicago.

Mr. Staunton criticised the figures as given out by the Illinois Central Railroad as to the probable cost of terminal electrification, and said that he thought they not only were too high in the matter of electricity supplied, but also that the railroad people made no allowance for the value of steam locomotives replaced, which could either be used on other parts of the system or sold to other companies.

Mr. A. Bement gave some interesting reminiscences of early electric lighting in Chicago. He also pointed out that the percentage of loss by radiation in steam power houses is greater when the boiler is banked than when it is in full operation.

Mr. Robert A. Kuss, of the city smoke department, alluded to the electrification problem and said that possibly self-contained electric or partly electric motor-car or locomotive units might be the solution of the problem.

Mr. O. E. Olson, superintendent at the Fisk and Quarry Street stations of the Commonwealth company, said that not as much smoke was now produced in one of the great Fisk Street stacks as from the stack of a 50-arc lighting plant a few years ago.

Mr. George H. Jones, of the Commonwealth company, mentioned the fact that the company now supplies electricity to 160,000 hp in motors, exclusive of railway load.

Mr. D. W. Roper, of the same company, spoke of the heating load due to the electric heaters in railway cars, which are operated from the central station. He noted the difference between two days recently, on one of which the heaters in the railway cars were not in use, whereas on the other they were turned on. The difference in current demand was 12,000 kw.

Mr. F. H. Bernhard asked if it would not be possible to utilize the exhaust steam, say, from the Harrison Street station, for heating buildings in Chicago, but Mr. Abbott said that the complications in conducting the steam under the streets of Chicago at the present time would render this plan impracticable. Others taking part in the discussion were Messrs. E. N. Lake, B. E. Strom, J. H. Warder and E. F. Smith. In closing Mr. Abbott emphasized the fact that not alone to the operating engineers must the reduction in the price of electrical energy be looked for. Such reductions, when accomplished, will be due more to improved methods and apparatus, and above all to a more careful consideration on the part of the designing engineer in laying out systems to be permanent through a long series of years. He repeated that the period of competition had passed; the period of municipal regulation is here.

Indiana Commission News.

The Indiana Railroad Commission has taken up the question of high-tension wire hazard with respect to the contact at crossings between telephone and telegraph wires with the high-tension wires of electric lines. In a circular prepared by Commissioner Dowling and sent to all the electric roads and all the steam roads paralleled by electric lines, it is stated that a number of fatal accidents occasioned by electric shocks had been reported to the commission recently.

With a view to lessening the electric hazard the commission is asking the railroads to furnish a list of all such dangerous wires where they cross lines where the steam and electric lines run parallel to each other, the station nearest to which the objectionable and dangerous wire is located, the number of telegraph or telephone poles nearest the wire, the height of the wire above the rails, why the wire is dangerous and the name and address of the owner of such wire.

When the information is collected, the commission will proceed to recommend immediate action calculated to do away with the live-wire hazard. The recent death of Motorman Plummer on the Indiana Union Traction line, who was killed while attempting to use the telephone to secure orders from the train dispatcher, is cited along with other accidents as reasons for taking precautions to do away with the hazard.

The commission has also issued a bulletin to the steam roads of the State recommending that in switching across interurban tracks they observe the same rules of stopping as are required to be observed at all main-line crossings where block signal towers are not maintained.

The commissioners say that in a large number of places where steam roads are paralleled by traction lines, the latter are cut by switches from the steam roads to elevators and other industrial plants. The traction employees always stop their cars on approaching such a switch, but on the contrary no stop is made by the trainmen in charge of steam cars. The commission hopes to make this rule extend to the steam roads.

Massachusetts Commission News.

The Massachusetts Railroad and the Boston Transit Commissions, sitting as a joint board, gave an important hearing in Boston on Oct. 20 upon the plans of the proposed Boston & Eastern Electric Railroad Company, which provide for a high-speed, double-track line upon a private right-of-way between Post Office Square, Boston, and Lynn, Salem, Beverly and Danvers. The project has been held back by the necessity of legislation to enable the road to build a tunnel and subway under Boston Harbor. The Legislature of 1909 referred this question to the above joint board, in connection with other transportation problems now at the front in Boston, and the joint board is to report its conclusions to the Legislature of 1910 early next January.

The hearing last week was mainly devoted to a discussion of the relations of the proposed road to existing and future facilities, the general line of argument being that it will take care of a class of suburban traffic which neither the steam roads, whether electrified or not, nor the street railways in the territory can properly and profitably handle. The company was represented by its counsel, Moorfield Storey, Esq., of Boston, and by its chief engineer, Mr. John H. Bickford, of Boston. Present in opposition were Attorneys William H. Coolidge, Esq., for the Boston & Maine Railroad; Bentley W. Warren, Esq., for the Boston & Northern Street Railway Company; Woodward Hudson, Esq., for the New York Central Lines; and Thomas A. Babson, corporation counsel of the city of Boston. Frederic E. Snow, Esq., was present on behalf of the Boston Elevated Railway Company.

Mr. Storey opened the case for the Boston & Eastern and stated that the company stands ready to build the road immediately upon authorization. Its engineering plans and esti-

mates, with figures of proposed schedules and anticipated earnings, have been favorably passed upon by such authorities as Messrs. William Barclay Parsons and H. M. Brinckerhoff, of New York, and J. R. Worcester, of Boston. Chief Engineer Bickford was then called, and briefly reviewed the plans of the company.

The proposed new road is to be of the third-rail type, without grade crossings, and will carry passengers from the heart of Boston to Beverly, 19 miles distant, in 23 minutes by express trains and 30 minutes by local runs. The trains are to be run on the zone system, no train making more than eight stops en route. The existing facilities cannot handle traffic in this way nor give suburban patrons the benefits of real high-speed service. The Boston & Eastern plans to run trains from 7½ to 15 minutes apart, with an all-night service proportioned to the traffic demands. The road can handle 15,000 passengers per hour, and the right-of-way will be wide enough for four tracks when business requires them. The total cost of the road, including the tunnel under Boston Harbor, will be about $11,000,000, and the tributary population is figured at 230,000, exclusive of the Boston terminus, earnings being calculated on the basis of $7 per capita per annum. The territory is densely populated and demands additional facilities. It is growing 88 per cent faster than the city of Boston and 63 per cent faster than the State as a whole.

The subways and tunnels of the Boston Elevated system were, according to Mr. Bickford, little more than elongated terminals for the reception and facilitated handling of surface-car traffic originating in the five-cent fare zone. The street railways in the outer suburbs have attempted to carry the cast-off traffic of the steam roads with indifferent success. The new type of electric railroad is ready to step into this field and stimulate patronage of all the facilities in the territory through its created travel, while reserving to itself the longer suburban patronage so indifferently cared for by the existing facilities. The schedule speed of the combined surface and elevated lines, including the subway and tunnel lines in Boston, is about 11 miles per hour, and he claimed that this is not sufficiently fast to enable the outer zone of suburban travel to be handled to advantage.

Danger to the profits of the Boston Elevated Railway Company, said Mr. Bickford, will result if it extends its rapid transit or elevated lines to considerable distances into the suburbs, and that even if this were done, the necessary fast service could not be given without sacrificing the intermediate suburban facilities and handling the traffic with great loss and serious congestion.

The public can look for no substantial reduction in fares if the steam roads are electrified, and unless motor cars are provided on separate tracks, the problem will be only half solved.

The Boston & Eastern fares are arranged on a basis of 1.25 cents per mile. On the Boston rapid transit system the average fare per passenger-mile should not fall below 1.5 cents for profitable operation, giving a radius of 3⅓ miles as the average length of haul that the company can afford to render for a single fare. The surface lines are the salvation of the Boston system, according to the arguments of Mr. Bickford. The greatest care must be taken not to extend the costly rapid transit lines of the city system into the outlying districts.

In conclusion Mr. Bickford discussed the route of the Boston & Eastern through East Boston and urged that it would not interfere with the profits of the present East Boston tunnel, which is owned by the city of Boston. He recommended extending the East Boston tunnel through to Bellingham Square, Chelsea, by a slightly circuitous route, and contended that if this should be done, there would be no competition of any amount between the two systems. Regarding the proposal to bring the present Boston, Revere Beach & Lynn Railroad into Boston through the Boston & Eastern tunnel, Mr. Bickford said that the company was willing to have this done if the summer traffic of the former road continued to be handled by the ferry service. He stated that it would be unprofitable and disadvantageous to bring such traffic into a costly tunnel, and there is no reason why expensive, high-speed service should be given to mere pleasure seekers. Later it may be desirable to electrify the entire Revere Beach system, and in such event it could be handled in connection with a second Boston & Eastern tunnel.

Mr. Bickford's testimony was largely cumulative under cross-examination. He stated that the Aurora, Elgin & Chicago Electric Railway runs into the city over the existing elevated lines, in reply to a question by Counsel Snow. Mr. Snow stated that the Boston company will be well prepared to receive traffic from outside roads at Sullivan Square as soon as certain changes can be made in the station, and that the conditions applying when the Railroad Commission formerly forbade the Boston & Eastern to terminate at this point would no longer be in effect. At the conclusion of Mr. Bickford's testimony the hearing then adjourned.

Final cross-examination of Mr. James C. Boyd, consulting engineer of the Westinghouse, Church, Kerr organization, for the Boston, Lowell & Lawrence Electric Railroad Company, was held before the Railroad Commission on Oct. 12. As stated in the issue of Oct. 21, page 971, the company is seeking a certificate of exigency to build a high-speed interurban railway on a private right-of-way without grade crossings between the cities named in its title. Cross-examination was conducted in the hearing of the twelfth by City Solicitor Kaan, of Somerville, and Attorneys B. W. Warren for the Boston & Northern Street Railway Company, W. H. Coolidge for the Boston & Maine Railroad, and C. M. Hight for the Lexington & Boston Street Railway Company.

Mr. Boyd stated that the company expects to deliver an average of about 4000 passengers per day to the Boston Elevated Railway Company at the Sullivan Square elevated station in Charlestown, and improvements are in sight for this station. Mr. Boyd reviewed the estimates of earnings for the road and discussed the possibilities of operating the line for about 50 per cent of the gross receipts. He stated that the probable passenger earnings per capita of other roads were applied to the Boston, Lowell & Lawrence conditions in order to estimate what might be expected in Massachusetts. The financial success of the other roads was not a point at issue, so far as per capita statistics on the new line were considered. He further stated that every road upon which Westinghouse, Church, Kerr & Company had estimated passenger receipts per capita had equaled or exceeded the estimates when placed in operation.

Mr. Boyd contended that the Boston, Lowell & Lawrence could handle trains with its multiple unit equipment much more rapidly in and out of the terminal station than the Boston & Maine; that the latter could not maintain as short headways in and out of its present terminal, even if two new tracks were available; and that the cost of electrification in the suburban zone of the Boston & Maine would be enormous in comparison with the $7,000,000 needed by the proposed line. More fast trains could be run with the high-speed electric road than on even the electrified steam system.

Mr. Boyd admitted that if 12½ per cent of the traffic of the Lexington & Boston Street Railway Company is through business between Lowell and Arlington Heights, taking two hours for the trip, the new road would doubtless take away a good deal of this. The possibilities of operating economy in the high-speed electric line arise from the absence of grade crossings, absence of track maintenance in paved streets, absence of heavy peak loads on the power station, use of steam turbine equipment at favorable load factors, high speed and low platform costs per car-mile. In conclusion Mr. Boyd discussed the traffic possibilities of the territory, emphasizing the creation of new business by new facilities, and citing the case of the Detroit, Ypsilanti & Ann Arbor electric line, which multiplied the travel 25 times between certain points along a route parallel to the Michigan Central Railroad on account of new facilities of transportation.

Wisconsin Commission News.

Commissioner John H. Roemer, sitting for the Railroad Commission, heard testimony in Milwaukee on Oct. 18 as to why a certificate of necessity and convenience should be given to the Milwaukee Western Electric Railway Company. The company proposes, if granted a certificate, to build an electric line from Beaver Dam to Milwaukee, passing through Hustisford and other towns in Dodge County, and North Cape and other towns in Waukesha County. The petitioners and witnesses testified as to the pressing necessity for such a road. Considerable data regarding freight and population in the territory which the road is intended to serve were introduced, which will be carefully verified and considered by the commission in forming its decision. It was brought out in the testimony that the patrons to be served by this road now have to drive several miles in order to obtain railroad transportation. Protests against the granting of this petition were filed by the Chicago & Northwestern Railway Company and by the Milwaukee Electric Railway & Lighting Company, although the latter was withdrawn upon condition that the petitioning company change its route into the city of Milwaukee.

The commission authorized the DePere Electric Light & Power Company to issue $10,000 worth of stock, to consist of 100 shares of common stock of a par value of $100 each. The stock is to be sold to supply the company with funds for the purchase of new machinery and the construction of the necessary lines and cables for extending and enlarging the business of the company.

The Cazenovia & Sauk City Railway Company petitioned for a certificate authorizing it to issue and sell 160 shares of its capital stock, each of a par value of $25, and to issue and sell $45,000 of its first-mortagage, 30-year, 5-per-cent bonds, and to issue 1040 shares of its capital of the aggregate par value of $26,000 to certain municipalities along its right of way and to receive in payment therefore the 5-per-cent 20-year bonds of said municipalities, the proceeds of the sale of all of which are to be applied to the purchase, acquisition and construction equipment for operation of a section of its road between LaValle and Cazenovia.

New York Public Service Commission News.

The Public Service Commission of the First District of New York has approved the bond issue of the Coney Island & Brooklyn Railroad Company, amounting to $107,000, which will be used for improvements and extensions. The proceeds of this bond issue will only return to the company about $85,000 cash, as the bonds, bearing only 4 per cent, cannot be sold at par. The company applied for authority to issue $372,000 in bonds, but this request was cut down by the commission on the theory that mere replacements must not be made a part of the capitalization of a company. The amount allowed was the sum which the engineers figured would be necessary for actual betterments.

Counsel for the Public Service Commission of the First District of New York has been instructed to bring proceedings in the Supreme Court, either by mandamus or injunction, to compel the Staten Island & Midland Railway Company and the Richmond Light & Railroad Company to exchange transfers at three points in West New Brighton, as had heretofore been ordered by the commission. The commission last spring, after hearings, ordered the companies to exchange transfers, first, at the points where the tracks approach within 20 ft. of each other; second, where there is actual connection between the tracks, and third, where the tracks of the two lines meet. This order has never been obeyed. The suit is not for the collection of penalties, but is a mandamus proceeding to compel compliance with the commission's orders.

In accordance with a private arrangement between the Public Service Commission and the general manager of the Interborough Rapid Transit Company, it was promised last week that the service in the subway would be increased 14 per cent by the lengthening of the rush hours, and by the addition of extra trains. It was stated that the service of the subway was maintained at this standard during the Hudson-Fulton celebration, and, as there were many complaints charging inadequate service, the commission insisted that the regular service be maintained up to the standard that prevailed during the emergency service.

The Public Service Commission, Second District, during the present week, will hear the case of the Great Bear Light & Power Company, which operates in the unincorporated village of East Worcester, Otsego County, and in the village of West Richmondville and Richmondville, Schoharie County, and which now seeks authority to operate in the unincorporated village of Worcester. It has been ordered to produce its books and papers in relation to the stock and bond issue authorized by the commission in March of last year. One of the stockholders of the company has complained to the commission of the manner of disposing of the capitalization authorized by the commission.

The commission will also hear at Albany the petition of the Port Jervis Traction Company for a certificate of convenience and necessity and for permission to issue a mortgage for $50,000 and bonds to the same amount; also $28,812.50 in common capital stock in connection with the street railway system in the city of Port Jervis; also an order to show cause made against the Twin State Gas & Electric Company as to alleged unlawful exercise of rights and privileges in Hoosick Falls.

The application of the Great Bear Light & Power Company for permission to exercise franchises in the unincorporated village of Worcester will be heard at Worcester.

Canadian Hydroelectric Commission.

At a meeting last week of the North Toronto Conservative Association in Toronto, Mr. W. K. McNaught, M.P.P., one of the members of the Hydroelectric Commission, stated that the Government transmission line from Niagara Falls to Toronto would be ready to deliver power in Toronto inside of six months, and he hoped that the city would be ready to distribute the power to the citizens as soon as the transmission line was completed.

Speaking in reference to the statement of Mr. McNaught, the city's electrical engineer, Mr. K. L. Aitken, stated that he was confident the city would be in a position to distribute the power within the city by the end of the six months' period mentioned by Mr. McNaught. There would not be lines to all the residences that would want light, but it was expected that the city would be able to serve the down-town district where the factories are. It was the policy of the city to keep poles off the high-class streets. One of the substations would be at the St. Lawrence market down town, and others erected probably at the Bay Street fire hall and in the basement of the City Hall. When the contract with the Toronto Electric Light Company expired Mr. Aitken stated the city would be ready to do the street lighting.

The electrical department has completed the work of remodeling the East Toronto electric light plant to make it suitable for receiving and distributing the Niagara power.

CURRENT NEWS AND NOTES.

ELECTRICITY FOR IRRIGATION.—The San Joaquin Light & Power Company, of Fresno, Cal., is increasing its generating equipment by 17,000 hp in anticipation of a large increase in the number of motors driving irrigation pumps along the eastern foothills of the San Joaquin Valley.

NEW PHYSICS BUILDING AT UNIVERSITY OF ILLINOIS.—The new physics building of the University of Illinois, at Urbana, Ill., is to be dedicated on Nov. 26, and the exercises incident to that occasion will extend over into the 27th. Prof. W. F. M. Goss, dean of the College of Engineering, is in charge of the arrangements.

N. E. L. A. COMPANY SECTIONS.—Steps are being taken for the formation of N. E. L. A. company sections by the employees of the Buffalo General Electric Company and the Toronto Electric Company.

CONTRACTORS' LICENSE CASE IN BALTIMORE.—The Maryland State Board of Electrical Examiners has revoked the license of a prominent Baltimore contractor for a period of 90 days for doing alleged unsatisfactory work. The board claims that this action was one of its perogatives—is within its powers—but the authority will be tested in the courts.

PUBLIC BENEFITS FROM HYDROELECTRIC DEVELOPMENTS.—A writer in a recent issue of the San Francisco *Chronicle* discusses in a convincing manner the benefits derived by California from the hydroelectric developments within the State. Not only have new industries been established on account of the electric power rendered available, but old industries have received lasting benefits. The storage of water during the flood period for use during the dry season has greatly increased the effectiveness of the natural-grade irrigation ditches, while electric pumps have caused land above the ditches to become equally as productive as that below.

ATTENDANCE AT THE NEW YORK ELECTRICAL SHOW.—The New York Electrical Show, at Madison Square Garden, which came to a close on Oct. 21, was visited by approximately 175,000 persons, according to the management. On the two last nights the crowds were so great that the police had to be called as a matter of precaution and very many persons were unable to gain admission. The exhibition was the most successful ever conducted, the attendance being over 30,000 more than last year. Contracts have been made with the owners of the Garden for next year's show, which will take place during the middle of October.

N. E. L. A. MEMBERSHIP.—In a talk before the Denver N. E. L. A. Section, President Frueauff referred to the recent increase in the membership of the National Electric Light Association from 1300 to 3400, which he believed clearly demonstrated the limitless possibilities ahead. The American Institute of Electrical Engineers has almost 7000 members, and as the possibilities of extending the membership of the N. E. L. A. are practically as 9 to 1, that body should have a membership nearer 34,000 than 3400 to equal what other organizations are doing. He said that during the present year an active campaign will be carried on to enlarge the membership.

CHICAGO PRESS CLUB INSPECTS GENERATING STATIONS.—Mr. Samuel Insull, president of the Commonwealth Edison Company, of Chicago, was the guest of the Press Club of Chicago at a luncheon at the home of the club on Oct. 22. Mr. Insull made a brief address reviewing the progress of the art and setting forth his belief that electric service should be a monopoly in every community. After the luncheon about 100 of the members of the club were taken on special trolley cars to the Fisk Street and Quarry Street generating plants, where the operation of these great stations was explained to the visitors.

CONFERENCE ON GROUNDING THE SECONDARY.—A conference was held in the rooms of the National Electric Light Association, Oct. 15, on the subject of grounding secondary circuits, at which representatives were present from that association, from the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies and the National Electrical Inspectors' Association. While all admitted that grounding is in general desirable, there was a difference of opinion as to the advisability of grounding from 150 to 300 volts, and after several hours of discussion no decision could be arrived at that would permit the drafting of a rule on the subject.

ELECTRIC MEASURING INSTRUMENTS.—Circular No. 20, issued by the Bureau of Standards, entitled the "Testing of Electrical Measuring Instruments," not only gives a list of fees for testing instruments, but contains an excellent outline of the characteristics of the various types of instruments now in commercial service. The descriptive matter covers ammeters, voltmeters, wattmeters, watt-hour meters, ampere-hour meters, recording meters and instrument transformers. Sources of errors, reliability of electrical instruments and apparatus for checking instruments are fully discussed. A copy of the circular will be sent to anyone upon request addressed to the Bureau of Standards, Washington, D. C.

LONG-DISTANCE WIRELESS.—It was announced last week that the Great Northern steamship *Minnesota,* plying between Seattle and Japan, was in communication with the Seattle and Japanese wireless stations every night during her trip. It is stated that she exchanged messages with the Seattle station until she was 3628 miles away. The ship is equipped with ordinary aerials, and with a generating apparatus of only 5 kw. The navy is soon to conduct experiments in long-distance wireless. Messages will be sent from Brant Rock, Mass., beginning probably in December, to the scout cruisers *Salem* and *Birmingham* at sea. Efforts will be made to communicate with these ships when they are 3000 miles away from the sending station.

WATER-POWER HEAD RIGHTS.—An injunction suit is being tried in the Superior Court at South Bend, Ind., involving the respective riparian rights of hydraulic power owners. The Mishawaka Hydraulic Company, which owns and maintains a power dam in the St. Joseph River, seeks to enjoin the South Bend Manufacturing Company, which owns and maintains a similar power dam a few miles lower down in the river, from forcing back water against its dam. The Mishawaka Company alleges that the South Bend Company has raised its dam to a height sufficient to back the water up to and destroy the power derived from turbine wheels. The trial will last more than three weeks and is attracting wide interest.

N. E. L. A. AND ELECTRIC AUTOMOBILES.—In an address before the Denver N. E. L. A. Section, President Frueauff said that the National Electric Light Association is this year giving considerable attention to electric automobiles. He did not consider that central-station men have been as alive to the possibilities along this line as they should be, that automobiles present a great opportunity for the improvement of the load factor, and as city streets are getting better the possibilities throughout the country are greatly improving. He believes that the larger cities will eventually legislate against the gasoline machine on the grounds that in crowded thoroughfares the stench from them is often a serious nuisance and particularly when it is known that the electric automobile will do the same work at a less cost.

DANGER IN ELECTRIC FIRE EXTINGUISHERS.—Considerable attention has been directed to what is known as the "dry shampoo case" in the London courts in which the manager and female assistant of a massage parlor are held for manslaughter because of the death of a woman after a dry shampoo. It appears that tetrachloride of carbon is the chief ingredient of the dry shampoo lotions, and Dr. Chaldicott, anesthetist of St. Mary's Hospital, testified that the fumes, according to the strength of the lotion, may cause fainting, giddiness and even death. Tetrachloride of carbon is inflammable and is a non-conductor of electricity. It is very volatile and heavier than air. Some of the best electric fire extinguishers are composed chiefly of tetrachloride of carbon, so that in applying the liquid the operator should be above the point of application or, being mindful of the poisonous quality of the fumes, should guard himself against them.

ST. PETERSBURG TRAMWAY ELECTRIFICATION.—The municipality of St. Petersburg, Russia, has elaborated a measure to electrify the remaining horse-car lines of that city, at a cost of $11,000,000, as against a cost of $9,400,000 for the lines previously electrified.

DR. STEINMETZ TO LECTURE IN CHICAGO.—At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, to be held at the rooms of the latter in Chicago, probably on Nov. 19, there will be an address by Dr. C. P. Steinmetz, of Schenectady, on a subject which has not yet been announced.

VALUES OF PUBLIC-UTILITY CORPORATIONS IN VIRGINIA.—The corporation commission report of values of public utilities up to June 30, 1909, for taxation for the current year, shows that telephone and telegraph companies occupy fifth place in the list, being valued at $2,617,000, while electric railways hold fourth place, with a total valuation of $8,643,000. The State tax on these items will amount to over $100,000.

INVENTORS' LEAGUE.—The Inventors' League, recently organized, held a meeting in Washington, D. C., Oct. 21, and decided to establish a monthly paper to be known as the *Inventors' Guide*. At the meeting the following officers were elected: First vice-president, Mr. George W. Bartlett, of Seattle, Wash.; second vice-president, Mr. O. H. Delmarton, Tampa, Fla.; treasurer, Mr. J. R. Kelley, Washington; financial secretary, Mr. C. C. Phillips, Washington.

ELECTRICAL EQUIPMENT OF THE NEW CORT THEATER, CHICAGO.—The new Cort Theater, at 76-82 Dearborn Street, Chicago, a rather small but attractive playhouse, was opened with its first attraction on Oct. 25. The electrical equipment of this cozy theatrical "bandbox" consists of 1500 16-cp lights, with the addition of 150 16-cp equivalents in electric signs. There are also four flaming arcs and 30 hp in motors, besides 24 50-amp charging plugs. The Commonwealth Edison Company supplies the electricity.

EXAMINATION FOR GEOLOGICAL SURVEY ELECTRICAL ENGINEER.—The United States Civil Service Commission will hold an examination Nov. 23-24 to secure eligibles from which to make certification to fill a vacancy in the position of junior electrical engineer in the technologic branch of the Geological Survey at a salary ranging from $960 to $1,200 per year, and vacancies as they may occur requiring similar qualifications. A list of the places at which examinations will be held may be obtained from the Washington office of the commission.

HIGH CONCRETE DAM.—The concrete dam, 178 ft. in height and 750 ft. long, which the Central Colorado Power Company is building on Middle Boulder Creek, is being erected at the rate of 600 cu. yd. daily, and will serve for storing the flood waters next spring. The concrete gravity pipe which leads from the dam to the forebay, where the water drops 1860 ft. to the power house, has been completed and most of it is in place. The power house near Boulder has been inclosed and most of the heavy equipment is in place. It is expected that it will be in operation during next summer.

TELEPHONE TRAIN DISPATCHING ON THE ROCK ISLAND.—As revealed by the recent annual report of the Chicago, Rock Island & Pacific Railway Company, the telephone system of train dispatching has been installed on 419.5 miles of the lines of that company on June 30, 1909. This installation of telephones for transmitting train orders has cost the company $33,214. Authority has been given for the equipment of 181 miles additional, and work is in progress for this extension of equipment, for which material has been purchased.

ELECTRICAL DEVELOPMENT IN URUGUAY.—Consul F. W. Goding, of Montevideo, reports that a French syndicate has made an offer to establish electric power houses to supply light and power to the inland towns of Uruguay. It binds itself to furnish apparatus, light and energy to the State as well as to the citizens at a price at least equal to the lowest price now paid in any of the towns. The concession is asked for 25 years, after which time the power houses, kept in perfect condition, will become the property of the State. The sum to be employed in the first installation, in the 18 towns not now provided with plants, will be $517,000, and the work will be completed within 18 months after the concession has been granted.

ILLINOIS STATE CONVENTION.—As this issue goes to press, the annual convention of the Illinois State Electric Association is being held at the Illini Hotel in Alton, Ill., the dates being Oct. 26, 27 and 28. A good program was prepared for this convention, including papers with the following titles: "Lighting Rates in Small Towns," Mr. W. J. Whetzel, Eureka; "Lighting Rates in Larger Towns," Mr. M. J. Linn, Bloomington; "The Relation of the Electric Vehicle to the Central Station," Mr. H. W. Dickerman, Rockford; "Gasoline Lighting," Mr. David Davis, Litchfield; "Power," Mr. F. H. Golding, Rockford; "Advantages of the Tungsten Lamp,' 'Mr. John G. Learned, Chicago. In addition there are various entertainment features and inspection trips.

TELEPHONES HERE AND ABROAD.—A correspondent of *The London Times*, in a comparison between the use of telephones in Europe and the United States, points out that in Europe, with a population of 400,000,000, only 2,300,000 instruments were in service on Jan. 1, this year, whereas in this country, where the population is not far from 85,000,000, nearly 7,000,000 telephones were employed on that date. England has a somewhat smaller number than three American cities combined—New York (334,186), Chicago (184,922) and Boston (more than 100,000). France makes a far less favorable showing (194,159), and Austria is credited with only 80,975. Italy, Belgium and Hungary are each said to have fewer telephones than St. Louis, Pittsburgh or San Francisco.

ANNUAL BANQUET OF CHICAGO BRANCH, N. E. L. A.—The annual banquet of the Commonwealth Edison Branch of the National Electric Light Association will be held at the Lexington Hotel, Michigan Avenue and Twenty-second Street, Chicago, on Thursday evening, Oct. 28. It is expected that about 300 members and guests will be present, and Mr. Frank W. Frueauff, of New York, president of the association, and Mr. Samuel Insull, former president, are to be the principal speakers. Mr. George H. Jones, president of the local branch, will preside at the dinner, and will turn the direction of affairs over to Mr. Louis A. Ferguson, another former president of the association, who will act as toastmaster. Mr. John W. Ferguson is chairman of the entertainment committee.

STREET-RAILWAY REHABILITATION IN CHICAGO.—For the first 9½ months of 1909, up to Oct. 15, the Chicago Railways Company reports that it has laid 99 miles of single-track railway on the streets of Chicago, making a total of 170 miles completed since the work of rehabilitation was begun. All the rails used in the new construction weigh 129 lb. to the yard, and there has been much special work, including curves and crossings. The new track does not constitute all the work that has been done, for several new buildings have been erected, including car houses, machine shops and offices. Mr. John M. Roach, president of the company, predicts that by the end of the year the construction operations of the company needed to comply with the ordinance will be finished. The company has had between 2500 and 3000 men at work on this new construction during the year.

IOWA COURT ON TELEPHONE MERGERS.—Judge McHenry on Oct. 20 denied at Des Moines, Iowa, an injunction asked by minority stockholders in the Mutual Telephone Company, stopping the Iowa Telephone Company, the Bell concern, from absorbing the mutual or independent line. The courts held that such a merger is not against public policy.

WATER-POWER INVESTIGATION IN JAPAN.—The next national budget of Japan, while containing measures for the reduction of taxes and greater economy in administration, nevertheless includes provision for several commercial projects of magnitude. One of these is the creation of a fund to be used in the investigation of water-powers in Japan which may be electrically utilized for industrial purposes.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS.—A regular monthly meeting of the Society of Wireless Telegraph Engineers was held in Boston on Monday evening, Oct. 11, at which Mr. John Stone Stone read a paper on "The Singing Arc and Its Application to Wireless Telephony." The paper consisted in part of an historical résumé of the development of the "singing arc" along lines which adapted it for use in wireless telephony. An explanation of the theory of the arc, illustrated by numerous diagrams and oscillograph curves, concluded the paper.

OZONE FOR NEW YORK SUBWAY AIR.—In a letter to the New York *Times,* Mr. John T. Morrow advocates the use of ozone generators on the cars of the New York subway in order to render the underground atmosphere more endurable. He suggests that several ozone generators of a small type that is now available be placed in each car of subway trains and connected to the electric lighting circuit. By this means not only would a large portion of germ life be destroyed by the ozone, but owing to the large amount of oxygen which the air would then carry a person would leave the subway with a feeling of exhilaration rather than depression.

INDEPENDENT TELEPHONE RATES INCREASED IN ROCHESTER.—The Rochester (N. Y.) Telephone Company (Independent) has been given authority to increase its rates by the Common Council of that city. Hereafter the authorized rate for unlimited business service will be $60 a year instead of $48. By the new schedule a rate of $48 a year is fixed for two-party service, and probably many small merchants will choose this rate instead of paying the higher price for unlimited service. Rochester has always been remarkably "Independent" in telephone matters, and during the numerous public hearings before the Aldermen, when the rates were under discussion, there appeared to be a strong public sentiment in favor of continued competition in the telephone business.

RADIO-TELEGRAPHY AND TYPE-SETTING.—A Norwegian naval officer, Captain Hovland, has invented a system of secret type-printing for radio-telegraphy, and lately gave a demonstration of it in Melsomvik, Norway, to the local authorities and pressmen. "Wireless" telegrams were exchanged between a station erected by the inventor and a station at Tjömö, belonging to the Norwegian navy, over a distance of 20 km. The characters are transmitted by means of a keyboard similar to that used on an ordinary type-writing machine. On reaching the receiving station the telegram may be received at will in secret or in ordinary type. Captain Hovland has had considerable aid from the naval authorities of Norway, at whose disposition he has placed the results of his work.

SMOKING CARS ON CHICAGO ELEVATED RAILWAYS.—In Chicago every train operated on each of the four elevated railways has one smoking car, but Mr. Clarence A. Knight, president of the Chicago & Oak Park Elevated Railroad Company, has announced that smoking cars will be abolished on that road. This decision is partly due to the fact that it is proposed to adopt a multiple-unit system of train operation which, owing to local conditions, will make it inconvenient to have smoking cars on all trains. Nevertheless, Mr. Knight thinks that after the plan is tried it will please the patrons of the road, although perhaps there will be some slight loss of patronage at first. Other elevated-railway presidents in Chicago are skeptical as to the success of the plan, or else are perfectly willing to wait and see it tried out on the Oak Park line first. There are no smoking cars on the surface lines, but smoking is allowed on the front platforms of cars. One reason why smoking cars are favored is that it gives a place for workingmen in their rough and soiled garments to ride with the consciousness that they are not giving offense to women passengers.

THIRTY-FIVE-YEAR-OLD EDISON PATENT CASE ADJUDICATED.—A decision was rendered in the United States District Court a few days ago in an Edison patent case which dates back to 1874, and which in its earliest days was a *cause célèbre.* The patent was on the quadruplex telegraph, and a remarkable complication arose through the claim of two parties that each had purchased the patent from Edison, one representing the Western Union Telegraph Company, and the other representing the Atlantic & Pacific Telegraph Company, then controlled by Jay Gould. One Harrington claimed an interest in the rights transferred to Gould, who turned the patent over to the Atlantic & Pacific Telegraph Company. The pooling arrangement between the latter company and the Western Union, giving Jay Gould control of the Western Union, followed the transfer of the patent, which in December, 1874, was said to be worth $4,000,000. After long proceedings a special master appointed in the case found it worth only $1,622,760 at the same period. The present action was brought against the Atlantic & Pacific Telegraph Company and the executors of the late Jay Gould by Harrington and others for a reargument of the motion to confirm the special master's report. In denying the application Judge Hough stated that the complainants had failed to show any damages or profits to the company by the use of the patent, and that a rise in stock values, which was one of the showings made in the bill, could not be said to show an increased value of the patent.

FUN WITH WELSBACH ELECTRIC LAMPS.—Our London contempory, *Electrical Industries,* refers to the entertainment incidentally afforded by the British Welsbach Company's offer to replace carbon-filament lamps with Welsbach tungsten-filament lamps, and take its return on the difference in quarterly bills. "The story goes that a Scotchman of the name of Mosenstein, or something similar, read the Welsbach Company's offer in his copy of the *Sunday Companion.* He closed one eye and opened it again, having in the interval come to a decision. He then rang up the manager of his vast warehouse in the city, and asked him what lamps were being used in it. The answer was that the lamps were metal-filament lamps, but not of the tungsten breed. MacMosenstein gave orders that the original carbon lamps were to be replaced at once. When that was done, he sent for the Welsbach Company, and said 'Hoot awa',' or words to that effect. Other reports come along which lift the lid off frightful conspiracies between contractors and their clients. When a consumer rings up his contractor and asks whether this offer should be accepted, the contractor, feeling that he need not consider the feelings of an ironmonger dealing in Welsbach lamps, or an ironmonger's friend, pays a special visit to his client, and advises him to accept the offer at once. He goes on to point out that the essence of the contract, from the consumer's point of view, is to leave the lamps on all night. If this is done on a sufficiently lavish scale, the subsequent bills will be larger than the old carbon lamp bills, and the Welsbach Company will have to be paid a negative sum of money."

Hydroelectric Development of the Uncas Power Company at Scotland, Conn.

THE Uncas Power Company, which transmits electrical energy to Norwich, Willimantic and Stafford Springs, Conn., has a rather interesting hydroelectric development on the Shetucket River at Scotland, Conn., a hamlet seven miles south of Willimantic. The station erected at this point is capable of developing about 1200 kw, the greater part of which is transmitted to Norwich, 11 miles away, at a tension of 22,000 volts. Here a substation is operated in conjunction with the municipal electric light plant and the energy is distributed at 2200 volts, two-phase, to the city circuits. The existing municipal steam station at Norwich is used as an auxiliary to the hydroelectric station at Scotland, the Uncas Power Company selling energy to the city of Norwich at the rate of 1.1 cent per kw-hour. The Willimantic Gas & Electric Company, which will maintain its own line and transformer station, will receive energy at the rate of 1 cent per kw-hour on a basic consumption of 1,000,000 kw-hours per annum; the energy being metered on the high-tension side of the transformers.

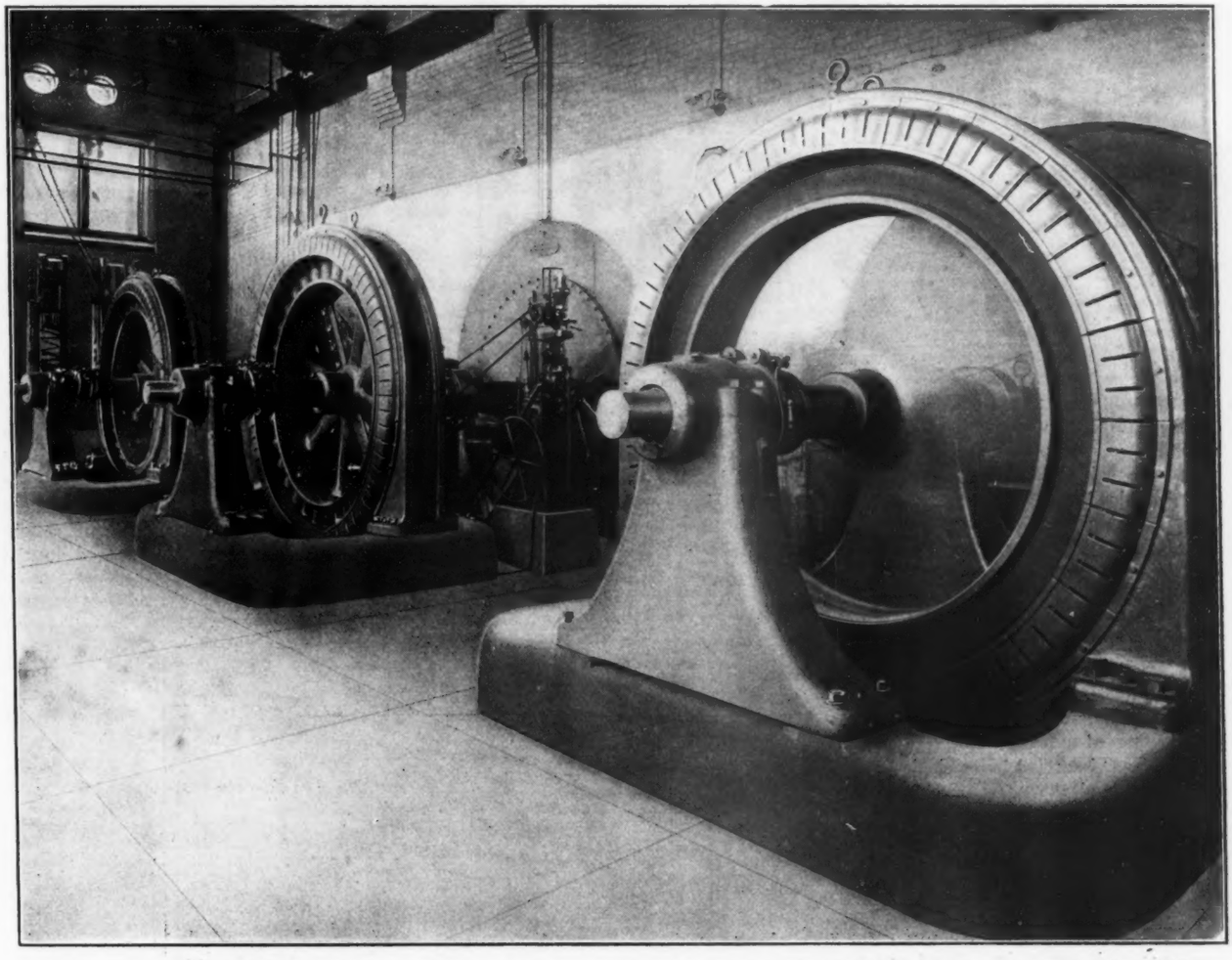


FIG. 1.—GENERAL VIEW OF HYDROELECTRIC STATION OF UNCAS POWER COMPANY.

An operating head of 25 ft. is obtained at the generating station by means of a concrete dam located at a narrow point in the river valley. The total length of this structure and the power house which adjoins it on the east is 470 ft. Its height above foundations is 36 ft. and about 27 ft. above the bed of the stream. The dam is made up of a number of different sections. The spillway section next the power house is of solid concrete; adjoining this is a hollow reinforced concrete dam, followed by a section containing five Tainter gates, and beyond this is an earth embankment with a reinforced concrete core wall. The original plans called for a solid concrete structure across the river; but a bottom of large gravel and small boulders was encountered after the first section was built on solid ledge, and the method of construction had to be modified radically in order to meet the changed conditions. The spillway adopted was of hollow reinforced concrete with a 60-ft. base, licensed under the Amburson Hydraulic Construction Company's patents. Tainter gates, quite common in the West but not so in the East, were also added to the design, and an earth embankment with a reinforced concrete core wall substituted instead of a concrete dam on the west bank. The length of the various sections, not counting in the widths of the piers between them, is as follows: Earth embankment, with reinforced concrete core wall, 170 ft.; Tainter gate section, 116 ft.; hollow reinforced concrete rollway, 80 ft.; solid concrete rollway, 20 ft.; power house, 70 ft.

A cut-off wall of sheet piling was driven beneath all the structures across the stream, with the exception of the power house and solid concrete spillway, which rested on the rock ledge on the east bank. For the core wall of the earth embankment on the west, 6-in. x 8-in. splined-timber sheeting was used. For the remainder of the distance across the stream, Wemlinger corrugated sheet steel piling was employed. Both the latter and the timber sheeting had a minimum length of 18 ft. below the bottom of the foundation at the point where driven. Two thicknesses of steel piling were used, according to the difficulty of the ground, ¼-in. material being used wherever the 3/16-in. sheeting was not strong enough to withstand the drive from a steam-hammer. A single row of timber

sheeting was used under the core wall of the earth embankment, and two lines under the Tainter gate and hollow reinforced concrete rollway sections, one line being placed under the upstream and the other under the downstream.

The core wall of the earth embankment is 12 in. thick for its entire length, and ⅜-in. twisted-steel bars were placed vertically on 15-in. centers, and horizontally on 4-ft. centers, with alternate horizontal bars in the upstream and downstream faces for reinforcement. Sand, gravel and loam taken from the foundation excavation and from pits on the west bank were used in making the earth embankment. Outward from the earth embankment, and separated from it by a retaining wall with wing walls, is a section 116 ft. across in the clear, containing five Tainter gates, which are utilized for getting rid of the flood flow of the river quickly. Each of the gates is 20 ft. wide and 13 ft. high; the face of the gate being on the circumference of a circle with a 14-ft. radius. The face is made of ¼-in. steel plates lap-riveted together, supported by radial arms and struts trussed to provide the requisite strength, and carried by steel pins at the center of the 14-ft. circle; the pins being bedded in the concrete piers. The latter are 4-ft. thick between adjacent gates, and are carried down from the walkway above the gates to the foundations, and backward to the downstream edge of the section; each gate being placed in a compartment by itself. In discharging water from the pond above the dam, the gates are raised from their seats, permitting the water to flow into a tumble bay. Two traveling crabs are employed in raising the gates. These travel on 15-in. 42 lb. I-beams spaced 2 ft. 5½ in. apart, and may be operated manually or by means of 3-hp motors fed from the exciter circuits. Two ¾-in. chains are attached near the lower edge of the gates 5 ft. each side of the center, and these pass over grooved-chain drums geared for manual or motor drive on the crab carriages. In the manipulation of the Tainter gates the operators are instructed to make certain that the track is clear, and that the hoists are ready to be moved from one gate to another. In winter, especially, ice must be kept from forming on the upstream side of the gate, a long rod being used to break the ice forming next to the steel shell. If water has been spilling over the top of the gate the ice between the concrete pier and the steel arms of the gate must be broken up, if any exists. The gate must always be raised slightly by hand before the motor is connected into circuit, so that there can be no doubt as to its freedom to move; a single lever being used for this purpose. When it is necessary to operate the gates manually, a handwheel is employed, rather than the single lever, and in cold weather heated oil is applied to the worm occasionally when operating the hoist, so as to insure smoothness of action and to reduce friction. When not in use the handwheels are protected from the weather, but must be ready at all times to be slipped on the operating shaft of the hoist so that manual operation can be employed if necessary. After the lifting motor has been started the dogs are disengaged from the chains, and when the gates are raised to the point desired the dogs are slipped into the chains and the gate lowered until the entire strain is taken from the hoist of the motor and carried by the dogs. This releases the traveling crab so that it may be moved to a new position on short notice.

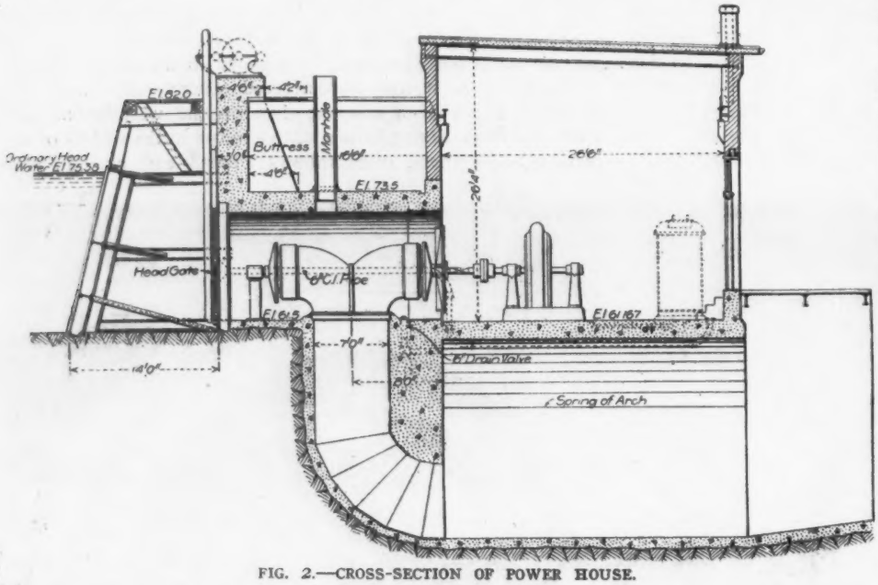


FIG. 2.—CROSS-SECTION OF POWER HOUSE.

The gates are made watertight by bolting 4-in. x 9-in. timber on the lower edge, which seats on a 2-in. x 8-in. timber bolted into a 9-in. channel imbedded in the concrete, with the legs upward. The sides between the steel gate and the piers are made watertight by means of flat-rubber strips fastened to the gates, and in order that these may not be worn out quickly and as a preventive against being caught in the rough concrete work, sheet metal was placed in the forms along the arc traced by the gate in opening and closing.

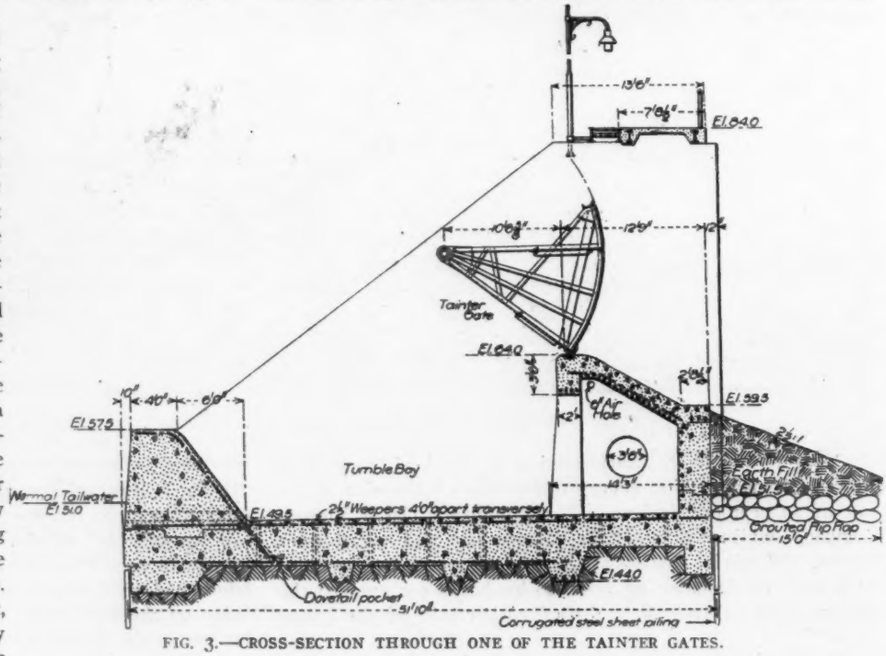


FIG. 3.—CROSS-SECTION THROUGH ONE OF THE TAINTER GATES.

In order to relieve any pressure of ground water beneath the section, 2½-in. tile weepers are placed vertically and extend through the concrete of the tumble bay floor. Any water coming up through the weepers must, of necessity, seep at least 18 ft. below the bottom point of the concrete foundation around the lower ends of the sheet piling. The seepage is discharged

from the tumble bay of each gate through five 10-in. circular weepers cast into the weir at the lower end of the tumble bay. The length of the foundation of the Tainter-gate section parallel to the flow of the stream is 51 ft., and cut-off walls of concrete are placed at the upstream and downstream edges, and at three intermediate points running transversely to the direction of the flow of the stream. Beneath the weepers at the lower end of the tumble bays is a reinforced concrete apron, and below this is a protection of reinforced concrete "book slabs" extending 70 ft. farther. Below the book slabs is the final protection against downstream erosion, consisting of riprap 3 ft. thick, extending for a distance of 30 ft.

A bridge on the Tainter-gate section is supported by 12-in. 13½-lb. I-beams covered by concrete with a reinforced expanded metal floor. Wrought-iron pipe railing runs along the upstream edge of the wall, while posts along the crab tracks are used as standards for lamps for night operation of the gates and for carrying the two conductors to which the leads of the hoist motors may be hooked.

The hollow reinforced concrete spillway section has a base 61½ ft. long. Its length is 80 ft. and its crest rises about 36 ft. above the lower point of the concrete cut-off wall in the foundation. The foundation on which this portion of the dam rests is of very compact gravel, and the floor is provided with concrete cut-off walls at the upstream and downstream edges and at four intermediate points. The concrete cut-off walls are cast around the tops of the rows of sheet-steel piling. The buttresses on the interior of the dam are spaced on 10-ft. centers, and are reinforced at suitable intervals with concrete struts. The buttress walls vary in thickness from 18 in. at the bottom to 12 in. at the top, and the struts are 12 in. x 15 in. The sloped upstream deck is 1 ft. 8 in. thick at the lower edge and 1 ft. 6 in. thick at the top. The sloped downstream apron is 1 ft. 8 in. thick. Ground-water pressure from below is prevented by tile weeper holes similar to those placed in the floor of the tumble bays, and any water coming through them is drained from the interior of the dam by 10-in. weeper holes between each two buttresses. Just below the crest of the dam a 3-in. vent hole is left in each panel so as to prevent a vacuum beneath the falling water. A walkway is provided through this

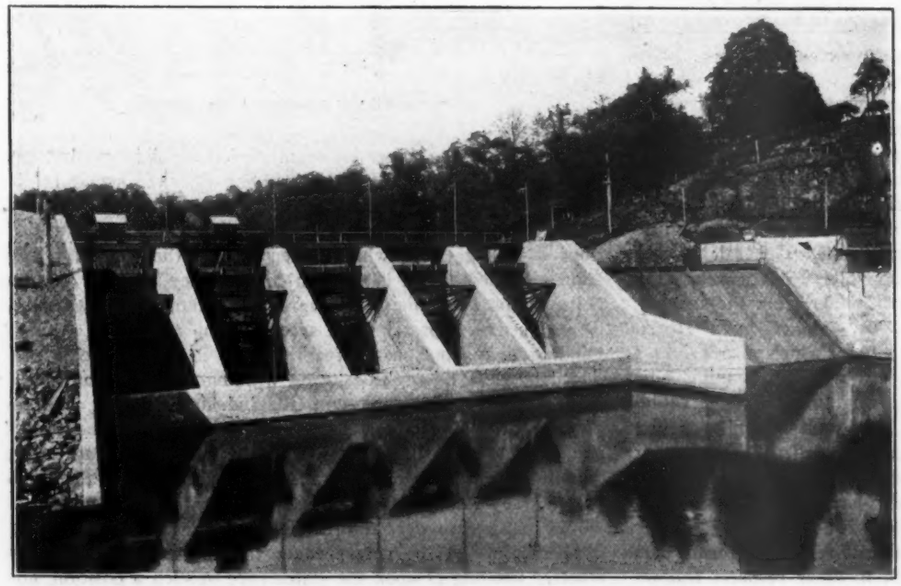


FIG. 4.—VIEW OF DOWNSTREAM SIDE OF DAM AND SPILLWAY.

section of the dam 5 ft. wide. Downstream from the reinforced concrete hollow dam is a concrete apron extending for a distance of 24 ft., and then riprap 3½ ft. thick as far as the riprap on the Tainter-gate section. The solid rollway section has a base of 35 ft., and rises 22 ft. above the rock ledge in the river bed.

The forebay was blasted out of solid rock, and is protected from floating logs and ice by a boom attached to the nose of the pier between the hollow dam and the solid concrete portion, so that all floating material will be discharged over the hollow concrete dam. A similar log boom is placed on the other bank, and terminates at the end of the hollow dam, thus affording protection to the earth embankment and to the Tainter-gate section.

The Tainter gates may be employed to hold the water

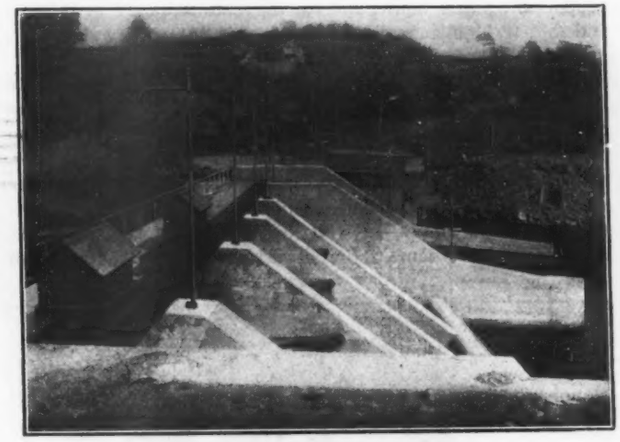


FIG. 5.—SIDE VIEW OF DAM SHOWING MOTOR HOISTS FOR GATES.

in the pond at a steady height, and in winter they may be manipulated to allow the water to pass out and to keep the ice back of the dam should there be any tendency of the ice to pack in the river below, and for this reason to back up water in the tailrace and thus reduce the available head. Provision has been made for a footway across the river, there being bridges over the Tainter gate and the solid concrete dam sections, and a walkway through the hollow reinforced concrete section. The latter is reached through manholes built into the piers between the hollow section and the Tainter gates on one side, and the hollow section and the dam on the other side.

The power house is 70 ft. long and 29 ft. 2 in. wide over all, and is built adjoining the solid concrete rollway section. The racks and penstocks are outside of the walls of the building, the racks being placed on a line with the upstream edge of the dam. These are made of 3-in. x ¼-in. bars placed 1¼-in. on centers, and supported by very heavy I-beam struts and knee braces. The latter have been designed to withstand the worst possible conditions—that is, when the rack bars are completely closed with ice, and bear a full head of water. The trash is removed from the racks from above, where a walkway is provided. The penstocks are of concrete 12 ft. wide, with vertical walls rising 8 ft., topped by an arch with a 2-ft. rise. The penstock for the exciter units is 5 ft. wide and 5 ft. high. These penstocks are built horizontally, and the waterwheels set inside of them and directly above the draft tubes. The latter are 7 ft. in diameter, and flare to an elliptical shape into the tailrace. The floor of the penstock is a few feet

above the level of the power-house floor, the penstock being separated from the power house by a cast-iron diaphragm, which also carries the main bearing between the generator and the waterwheels. Each penstock can be cut off from the forebay by means of heavy timber gates operated by hand from a bridge at the power-house roof level. When the penstock has been cut off by dropping the gate, it can be drained through a duct closed with a plug valve. Each penstock can be entered from the bridge above through a manhole made of boiler plate. The downstream arches, into which the draft tubes discharge, support the power house, and for the main units are 15 ft. wide and 18½ ft. high, and for the exciter unit 5 ft. wide and 14½ ft. high.

The three main units are 33-in. wicket gate waterwheels mounted two on one shaft, and manufactured by the S. Morgan Smith Company, of York, Pa. Each set is rated at 650 hp and direct-connected to a 400-kw, 2300-volt, 60-cycle alternator, manufactured by the General Electric Company. The exciter unit consists of one pair of 12-in. wicket gate wheels, direct-connected to a 40-kw, 125-volt generator. An additional exciter unit of the same rating is driven by a 60-hp induction

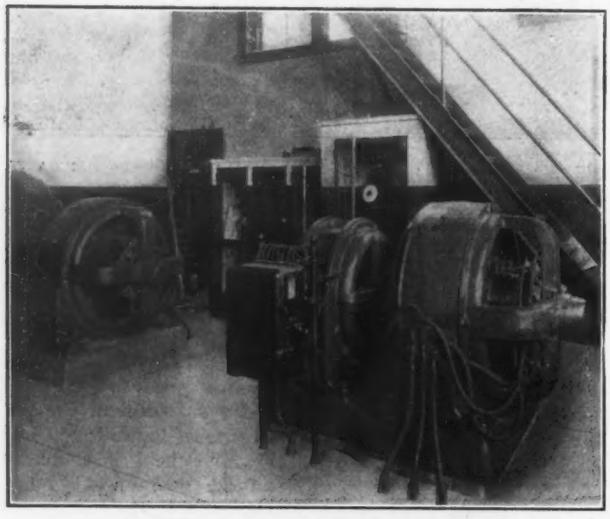


FIG. 6.—TURBINE- AND MOTOR-DRIVEN EXCITER SETS.

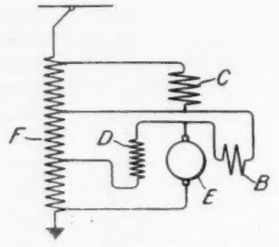
motor, equipped with a starting compensator. Lombard waterwheel governors are used on the main units, and a Woodward governor on the exciter unit. The governor of the main wheels may be controlled from the switchboard. A 5-ton hand-operated traveling crane extends over the entire operating room.

The output from the generators is transmitted through three 400-kw, 60-cycle, oil-insulated, water-cooled General Electric transformers, at a tension of 22,000 volts, to Norwich. The cooling water for the transformers is taken from the forebay, but in case of an emergency may be supplied by a Morris centrifugal pump belted to a 2-hp motor, which also drives a compressor for furnishing compressed air for cleaning purposes. A General Electric spark-gap, lightning arrester equipment is installed on the outgoing lines, and a similar equipment is installed in the substation at Norwich. The generator and transmission circuits are controlled from a six-panel switchboard. The generator panels have hand-operated oil switches, and electric push-button controllers for the motors on the waterwheel governors. A Tirrill regulator forms part of the switchboard equipment, which in other respects follows standard practice.

A single three-phase, 22,000-volt line, consisting of No. 4 hard-drawn copper wire on porcelain insulators, is carried on 40-ft. wooden poles. The line follows the Shetucket River to a point above Baltic, and then crosses the hills and open country to Norwich. Except for a small portion of the line on the highways, the circuits are carried over private right-of-way. At Norwich the tension is stepped-down from 22,000 volts to 2300 volts, and the current changed from three-phase to two-phase by means of two banks of transformers. The switchboard at the station comprises four panels, two for controlling incoming lines and two for outgoing lines. The municipal plant, in one corner of which the substation is erected, contains 1000 kw of 2300-volt, two-phase, alternating-current machinery, and a 100-kw rotary converter set, giving 550-volt, direct current for operating motors in the various city buildings. The hydraulic engineering features of the Uncas Power Company's plant were designed by Mr. William G. Fargo, Jackson, Mich., and the contractors were Messrs. Tucker & Vinton, of New York City. The work was originally started in March, 1907, and resumed again in April, 1908, the plant beginning operations a few months ago. The officers of the company are: President, Mr. C. W. Comstock; secretary, Mr. J. D. Hall; treasurer, Mr. Z. R. Robins; and Mr. M. S. Caldwell is the superintendent of the station.

Single-Phase Commutator Motor.

A patent issued on Oct. 5 to Mr. E. F. W. Alexanderson relates to constructive features of the "series-repulsion" motor with which this inventor's name has been associated. The machine starts from rest as a repulsion motor with its armature short-circuited; but for high-speed operation the exciting winding on the stator is connected in the armature circuit and a shunt voltage is impressed on the armature and exciting winding in series, and a second shunt voltage is impressed on the exciting winding alone through a reactance. The arrangement is shown in the accompanying diagram. The purpose of impressing the shunt voltage on the armature circuit *E* is to reduce the strength of the inducing field, which field is beneficial at low speeds as regards commutation, but has an exces-



SINGLE-PHASE COMMUTATOR MOTOR.

sive and injurious effect on commutation at high speeds. The object of including the exciting winding *B* in the armature circuit is to shift the armature current somewhat out of time-phase with the current in the inducing winding *C*, so as to produce a leakage field which, when cut by the armature coils short-circuited by the brushes in commutation, induces in those coils e.m.fs. neutralizing the e.m.f. of commutation reactance. The object of impressing the second shunt voltage on the field winding is to compensate for the drop in power factor produced by connecting the exciting winding in the armature circuit, instead of in circuit with the inducing winding, and the purpose of the reactive winding *D* in series with the second shunt voltage is to prevent this second shunt voltage from definitely fixing the amount and time-phase of the field flux and thereby making the motor essentially a shunt motor, as would be the case were the reactive coil omitted.

The claims of the patent cover the scheme of placing the reactive winding *D* upon the stator core in such a position, and so connected, that it is non-inductively related to all other windings on the motor. It is placed in slots which would otherwise be occupied by the inducing winding *C*, alternate coils being reversed in connection so that there is a non-inductive relation between these two windings. The interconnections are such that the winding *D* produces twice as many magnetic poles as there are armature poles, and hence there is a non-inductive relation between the armature winding and winding *D*.

The Transmission of Electrical Energy in Southern California.

IN the distribution of electrical energy in Los Angeles three companies are interested, namely, the Los Angeles Gas & Electric Company, the Pacific Light & Power Company and the Southern California Edison Company. The first-named company obtains its energy exclusively from steam, while the other two depend largely on water for their source of supply. Thus the transmission of electrical energy to Los Angeles, and also throughout a large part of southern California, is controlled by the Pacific Light & Power Company and the Southern California Edison Company. The present article gives an outline of the generating apparatus and transmission systems of these two companies.

THE PACIFIC LIGHT & POWER COMPANY.

The Pacific Light & Power Company owns and controls five hydroelectric and three steam generating stations. The principal hydroelectric station is located at Borel, Kern County,

FIG. 1.—MAP OF TRANSMISSION SYSTEM OF PACIFIC LIGHT & POWER COMPANY.

Cal., its energy being derived from the Kern River. The station equipment consists of five 2000-kw, three-phase, 2200-volt, revolving-field generators directly connected to turbines operated under an effective head of 246 ft. The generators are operated on the unit system, the e.m.f. of each being raised to 66,000 volts through a bank of three 750-kw, General Electric, oil-insulated, water-cooled transformers. The energy generated at this station is transmitted to Los Angeles over two independent pole lines each equipped with three No. 3-0 copper wires. The distance between the generating station and the receiving station is 127 miles. As indicated on the map, shown in Fig. 1, four switching stations are installed on the line at Indian, Oak, Lake and Newhall, situated, respectively, 25, 44, 71 and 96 miles from the generating station. An idea of the arrangement of the switches and the change-overs that can be made by means of them will be gained from Fig. 2. The receiving station in Los Angeles is equipped with four transformer banks, each of which consists of three 750-kw, oil-insulated, water-cooled General Electric units designed to decrease the e.m.f. from 66,000 volts to 15,000 volts to feed into the company's high-voltage distributing circuits.

A single-unit hydroelectric plant operating at constant load is located at Mentone, Cal., on the Santa Ana River, about 65 miles east of Los Angeles. This plant contains one 1500-kw, 2200-volt, two-phase, 50-cycle Westinghouse generator directly connected to a Doble waterwheel operating under an effective head of 352 ft. The water is conveyed to the plant through a 36-in. wood-stave pipe line 3.5 miles in length. The load is kept constant on the machine, use being made of a deflecting nozzle in order not to disturb the flow of water, which is used for irrigation. The e.m.f. is raised to 17,500 volts by two water-cooled Stanley transformers T-connected to deliver three-phase energy.

A second station, deriving its energy from the Santa Ana River, is located at Riverside, about 55 miles from Los Angeles. It is equipped with two 300-kw General Electric, 11,000-volt, three-phase, 50-cycle generators directly connected to Stillwell-Bierce turbines operating under an effective head of 85 ft. The e.m.f. is raised to 17,500 volts by means of three 200-kw Stanley oil-insulated, water-cooled transformers.

The smallest hydroelectric station of the company is one equipped with two 300-kw Westinghouse, 50-cycle, 500-volt, two-phase generators directly connected to Pelton impulse waterwheels operating under a head of 590 ft. Two banks of Westinghouse oil-filled, water-cooled transformers serve for increasing the e.m.f. to 17,500 volts, three-phase.

A station at Azusa contains five 500-volt, two-phase, 50-

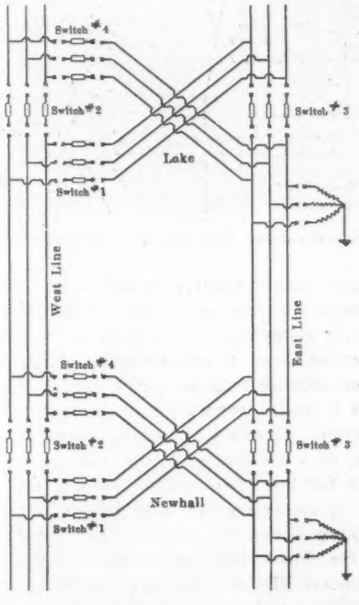


FIG. 2.—WIRING DIAGRAM OF SWITCH STATIONS.

cycle Westinghouse generators directly connected to Doble waterwheels operating under an effective head of 396 ft. Five banks of Westinghouse transformers increase the e.m.f. to 17,500 volts, three-phase.

In the Third Street steam station there are one 300-kw Westinghouse, 2400-volt, two-phase, 60-cycle generator belted to a Hamilton-Corliss non-condensing engine; one 750-kw, 2400-volt Westinghouse, two-phase generator directly connected to a cross-compound McIntosh & Seymour condensing engine, and one 1500-Bullock generator of the same type directly connected to a similar engine. These generators supply energy to the high-tension distributing system through three banks of Westinghouse transformers, each consisting of two 625-kw units

arranged for converting to 15,000 volts, three-phase. This station is used for relay purposes, the above-mentioned transformers acting as step-down units whenever the steam-generating station is not operating. This station also contains two 225-kw, one 250-kw and two 400-kw rotary converters.

A steam station at Sixth Street and Central Avenue, Los Angeles, is equipped with three Bullock and two Stanley 1500-kw, 50-cycle, 2300-volt generators, four of which are directly connected to McIntosh & Seymour cross-compound condensing engines, the fifth being directly connected to a Nordburg cross-compound condensing engine. The station also contains one 1050-kw Westinghouse, 550-volt, direct-current generator directly connected to a McIntosh & Seymour cross-compound condensing engine.

The largest and most unique steam station is the one at Redondo, which contains three General Electric 5000-kw, 18,000-volt, 50-cycle, three-phase generators directly connected to McIntosh & Seymour vertical, cross-compound, condensing engines. The energy from this station is fed directly to the high-tension distributing system of the Los Angeles Railway Company and the Pacific Electric Railway Company. In these stations use is made of crude oil as fuel. A fully illustrated description of the Redondo station appeared in our issue for Sept. 12, 1908.

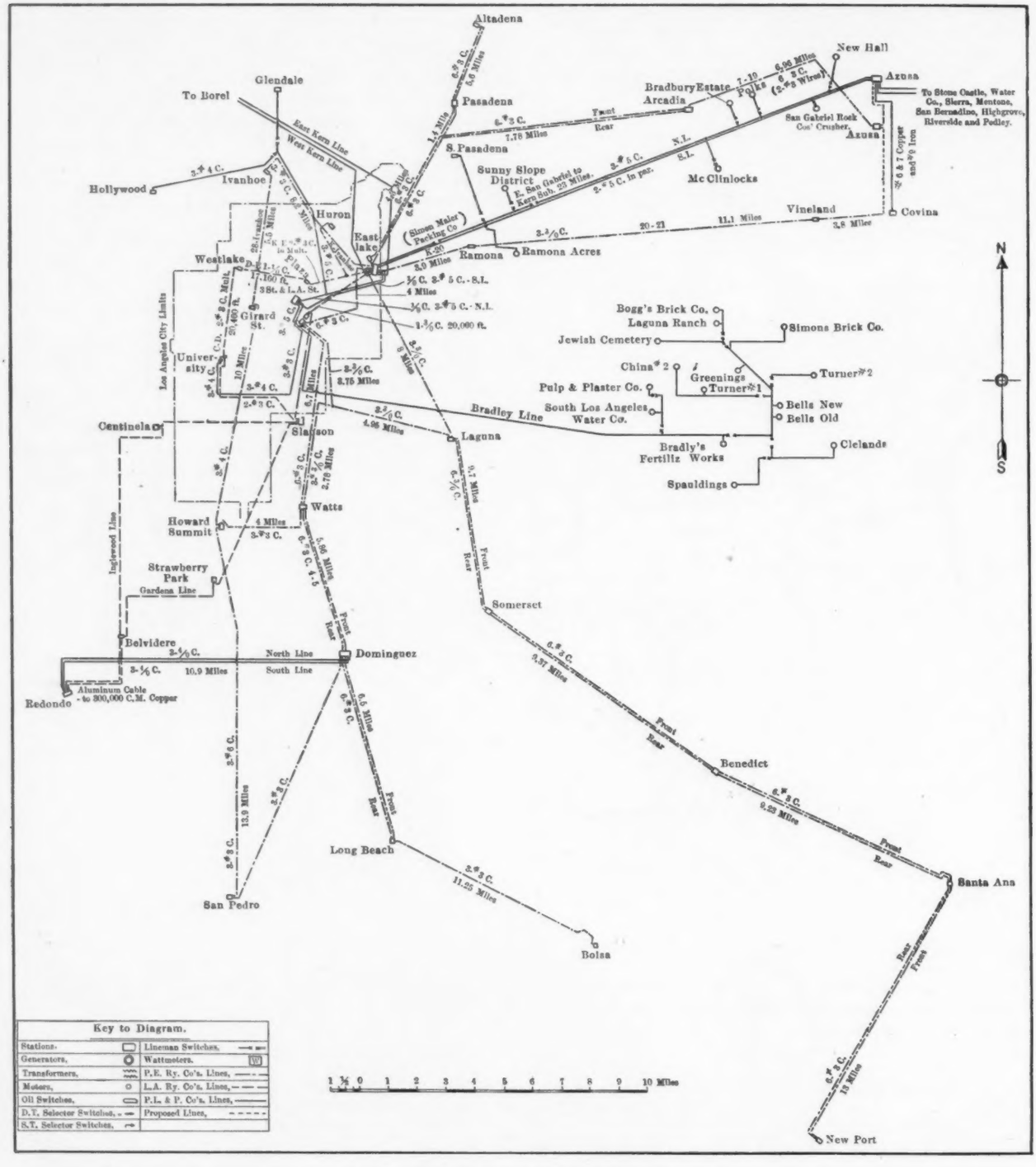


FIG. 3.—DIAGRAM OF 15,000-VOLT CONNECTIONS.

A diagram showing the 15,000-volt distributing circuits of the Pacific Light & Power Company is given in Fig. 3, which gives some indication of the nature of the load on the system. In addition to its very large railway load, the company supplies energy to a large number of industrial establishments and to many pumps for irrigation. Moreover, its commercial department furnishes electricity for lamps and motors in the towns of Riverside, San Bernardino, South Pasadena, Azusa, Alhambra, Covina, San Gabriel, Huntington Park, Glendora, Dolgeville, Corona, Hollywood, Arcadia and Los Angeles.

The president of the Pacific Light & Power Company is Mr. W. G. Kirchhoff, the general manager Mr. A. C. Balch, and the electrical engineer Mr. E. R. Davis.

SOUTHERN CALIFORNIA EDISON COMPANY.

A transmission system of more than ordinary interest, on account of the large number of widely separated generating stations that are operated in parallel and by reason of the limitations imposed upon the hydraulic units and the unusual character of the load, is that of the Southern California Edison Company. This company owns seven hydraulic and four steam stations, the prime movers in which have a total rating of 55,500 hp. Although the distance between two of these stations reaches a value of almost 200 miles, all of the 11 stations are normally operated in parallel. An idea of the character of the load, which will be discussed more fully below, may be obtained from the statement that the distributing circuits extend from the summer mountain resorts to the winter resorts in the lowlands, and cover a territory where artificial irrigation has reached its highest development.

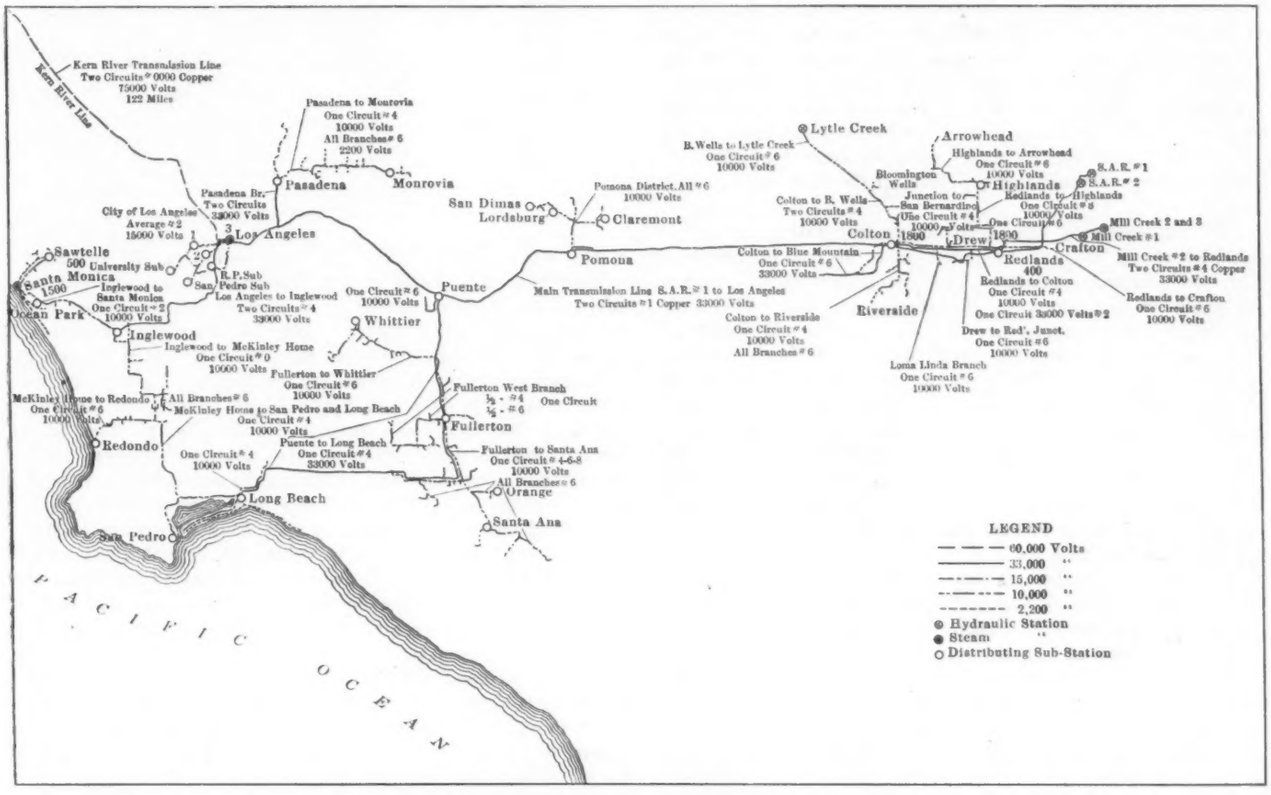


FIG. 4.—MAP OF TRANSMISSION SYSTEM OF THE SOUTHERN CALIFORNIA EDISON COMPANY.

Fig. 4 is a map of the transmission and distributing systems, giving the size and voltage of the various circuits and showing the locations of the generating stations and substations. Beginning at the eastern side of the map, the Santa Ana River station No. 1 contains three Pelton and one Doble waterwheel operating under a head of 760 ft., each of which drives a 750-kw, three-phase, 50-cycle, General Electric generator wound for 750 volts. Four banks of transformers, three of which are of the air-blast type and one oil-cooled, serve for raising the e.m.f. to 33,000 volts. In the Santa Ana River plant No. 2 there are two Doble waterwheels, designed for a 305-ft. head, driving two 600-kw, General Electric, 750-volt, three-phase generators. Six 175-kw transformers of the air-blast type are used for increasing the e.m.f. to 33,000 volts. These two plants are situated along a stream all of the water of which is used for irrigation. It is necessary, therefore, so to operate the plants as not to interfere even momentarily with the flow of water. In order to obtain this result the waterwheels are provided with deflecting nozzles. However, the plants are operated continuously at such loads as will use all of the water to the best advantage. That is to say, the wheels are run without the governors, which come into play only in case of an excessive decrease in load on the system.

There are three separate hydroelectric developments on Mill Creek, although there are only two generating stations. Development No. 1 utilizes three Pelton wheels under a head of 510 ft. for driving 250-kw General Electric, three-phase alternators designed for 2500 volts. Two banks of Westinghouse water-cooled transformers raise the e.m.f. to the transmission value of 33,000 volts. The generating apparatus for developments Nos. 2 and 3 is placed in a common station building, although two different hydraulic heads are used. Three Doble wheels and one Pelton wheel utilize a fall of 1960 ft. Each of these wheels drives a 750-kw, 750-volt, three-phase alternator, while a fifth Pelton wheel operating at 630 ft. drives a 250-kw generator. The water in Mill Creek is used for irrigation, so that the same restrictions apply to this stream as to Santa Ana River. However, conditions are frequently such that certain of the wheels operate with governors for varying the load without altering the flow of the water.

As intimated above, and as will be noted from Fig. 4, the energy from the Santa Ana and the Mill Creek plants is transmitted at 33,000 volts. What may be called a secondary transmission e.m.f. or a primary distributing e.m.f. of 10,000 volts is

used for conveying the energy from the various transformer substations located along the route of the 33,000-volt circuits. One of these substations, which is at Redlands, contains an 1890-kw transformer equipment for the local load and for supplying energy to resorts along the San Bernardino Mountain. A second transformer station is at Colton for supplying energy to the Riverside and San Bernardino neighborhood; it is equipped with 1800 kw in transformers. In the 10,000-volt circuits from the Colton transformer station energy is fed directly from two 250-kw, 10,000-volt generators driven by Pelton wheels receiving the water of Lytle Creek under a head of 483 ft. These machines are usually run at constant load. The Kern River plant was started successfully on Sept. 1.

Although at the present time the plant on the Kern River is out of service, on account of certain repairs and changes that are being made in the hydraulic tunnels, so that energy is now being transmitted toward rather than from Kern River, yet mention should be made of the normal conditions under which this plant operates. The plant consists of four pairs of Allis-Chalmers impulse waterwheels utilizing a head of 874 ft., each of which drives a 5000-kw, 50-cycle, three-phase alternator wound for 2300 volts. There are four banks of transformers for raising the e.m.f. to either 56,000 volts, 66,000 volts or 75,000 volts for transmitting energy 122 miles over a steel-tower line to Los Angeles. Under ordinary service conditions the wheels in the Kern River plant operate under complete control of the governors to carry the fluctuating portion of the load on the whole system.

For supplementing the hydroelectric generating equipment outlined above, as may be noted, and for use in emergencies, the company maintains four steam generating stations favorably located along its distributing circuits. The most important steam stations are at Los Angeles and Redlands, while smaller stations are in Santa Monica and Santa Barbara. The Los Angeles station contains two 2000-kw, 2300-volt, Curtis-General Electric steam-turbo units and one 6000-kw, 15,000-volt generator of the Westinghouse-Parsons type. Energy is transmitted from this station at 15,000 volts to five substations in the Los Angeles neighborhood, the substations being known as Los Angeles No. 1, Los Angeles No. 2, San Pedro, University and River Power, which are equipped for 1275 kw, 4250 kw, 525 kw, 1200 kw and 750 kw, respectively. The Los Angeles station contains not only the above-mentioned generating apparatus, but it is equipped with transformers for receiving energy at 56,000 volts, 66,000 volts or 75,000 volts from the Kern River plant and 33,000 volts from the Santa Ana, Mill Creek and Lytle Creek plants. Thus its transformer equipment acts as the connecting link between steam and hydroelectric stations rated at 10,000 kw and 29,610 kw, respectively. However, only a part of the power from the generating stations passes through the transformers, which have a total combined rating of only 26,700 kw in 21 units.

A single 450-kw, 2300-volt alternator comprises the generating equipment of the Redlands steam station. However, the station contains a transformer installation rated at 1890 kw for delivering or receiving energy at 10,000 volts and 33,000 volts. The Santa Monica steam-generating equipment is rated at 200 kw, but the transformer banks, of which there are two, have a combined rating of 1000 kw. The Santa Barbara station contains two 500-kw, 2200-volt alternators and two 500-volt generators, having a total rating of 500 kw.

In addition to the substations mentioned above, there are substations at the following places for receiving energy at 33,000 volts: Pomona, 750 kw; Puente, 450 kw; Fullerton, 2400 kw; Long Beach, 3000 kw; Pasadena, 2550 kw; Inglewood, 2400 kw.

An inspection of the above substation ratings and a study of Fig. 1 will show the geographical distribution of the load on the whole system. It will be noted that not far distant from the Santa Ana and Mill Creek and Lytle Creek stations, with their 9610 kw of generating equipment, there are substations at Redlands and Colton with transformer equipment of 3690 kw for distribution, while along the line to Los Angeles and its branches there are substations at Pomona, Puente, Fullerton, Long Beach and Pasadena, having 9100 kw in transformers. It would seem, therefore, that energy from the two plants along the Santa Ana River, the three plants along Mill Creek and the Lytle Creek plant is seldom transmitted to Los Angeles, but is used for various purposes along the route before reaching that city. Either the Kern River plant or the Los Angeles steam station is capable of supplying all of the power required at the substations in the Los Angeles district. However, when the plants are connected normally in parallel, the operation of the system as a whole is much more satisfactory and reliable than when the separate plants supply energy exclusively to consumers in their immediate neighborhood.

In addition to its lighting loads at the various places mentioned above, and shown on the map in Fig. 4, the company supplies energy to street cars at Redlands, Colton and Riverside and there are connected to its circuits various motors for driving cement mills, rolling mills, ice machines, irrigation pumps, etc. It will be noted that the industrial load is of a very advantageous nature, as viewed by the supply company, on account of both the daily and seasonal load factor. An ideal of the daily load factor can be gained from Fig. 5. The high "valley" load is attributable to the 24-hour industrial load which forms about one-third of the maximum load and one-half of the average load. The smallness of the seasonal variation in the load will be appreciated at once from the nature of the industrial load. However, it is worthy of note that the railway portion of the load, and even the lighting load, maintains a high seasonal load factor on account of the fact that both winter and summer resorts obtain their supply of electricity from this company's system.

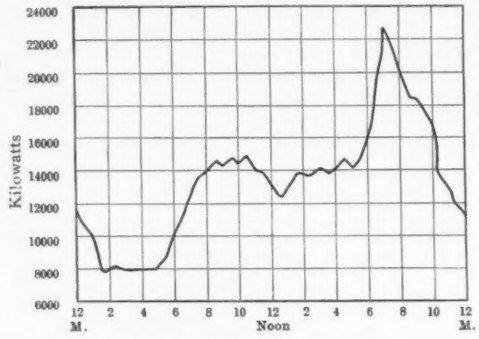


FIG. 5.—DAY LOAD CHART.

Complete technical descriptions of the Mill Creek, Santa Ana River, Lytle Creek and the steam plants of the company appeared in our issues for Feb. 25, March 4, 11 and 25, and April 8, 1905, while the Kern River installation and transmission system were illustrated and described in our issues for Aug. 10, 17, 24 and 31, 1907.

The president and general manager of the Southern California Edison Company is Mr. John B. Miller. The superintendent is Mr. B. F. Pearson, and the electrical engineer is Mr. J. A. Lighthipe.

Training of Electrical Engineers.

In a lecture on the subject of "Electrical Inventions and the Training of Electrical Engineers," recently delivered at the University of London, Prof. J. A. Fleming laid stress upon the necessity for diligent work in the laboratories of the universities and technical colleges, and suggested the desirability of carrying out scientific and commercial testing work. Students were also advised to visit various works and power stations whenever a chance presented itself, and if possible to go to America and the Continent, where large hydroelectric power stations may be seen, and other things of educational value not to be found in England. He expressed the opinion that a good constitution was the most essential thing that a young man should possess to enable him to become a successful engineer, because the engineering profession is exceptionally arduous.

Calculation of the Voltage Regulation of Transmission Lines.

BY J. E. DALEMONT.

PRACTICAL methods for calculating transmission lines with reactance have been given by different authors, such as Mr. Ralph D. Mershon and Prof. L. A. Herdt in America, while in France the same question has been treated by Blondel, Pionchon, Barris, etc.*

The very simple chart published by Prof. L. A. Herdt in the *Electrical World* of Jan. 2, 1909, is sufficiently accurate for practical purposes, although, as the author himself points out, it will not give exact results for calculating the voltage regulation, when the power factor of the receiver is unity. With equal facility one may calculate by means of the two following very simple formulas the size of the conductors and the voltage regulation of any transmission line with reactance and with any power factor:

Let v_0 be the voltage at the generator end per mile per ampere.

v, the voltage at the receiving end per mile per ampere.

$\frac{v_0 - v}{v}$, is the regulation.

z, the e.m.f. drop *of the line* per mile per ampere (= impedance per mile).

x, the self-inductive e.m.f. *of the line*, per mile per ampere (= reactance per mile).

r, the resistance drop *of the line* per mile per ampere (= resistance per mile).

$\cos \Theta$, the power factor of the receiving circuit.

The triangle of the tensions is shown in the accompanying

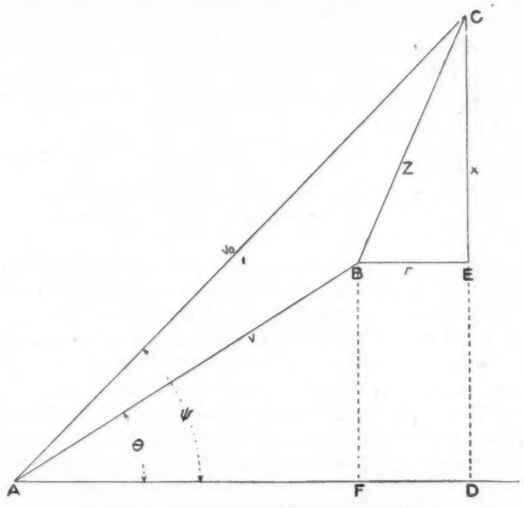


DIAGRAM SHOWING VOLTAGE RELATIONS.

illustration. It will be noticed that with a given frequency and distance between the wires, the value of x remains almost constant, and in any case varies so little, that the variation relatively to the value of v may be neglected.

From the illustration we may deduce:

$$CD = v_0 \sin \Psi$$
$$CD = v \sin \Theta + x$$
$$\sin \Psi = \frac{v}{v_0} \sin \Theta + \frac{x}{v_0} \qquad (1)$$

On the other hand:

$$BE = r = AD - AF$$
$$r = v_0 \cos \Psi - v \cos \Theta \qquad (2)$$

The values of x for single-phase lines may be found in columns 4 and 8 of the table, while those for three-phase lines appear in columns 5 and 9, and are equal to one-half of those for the single phase lines.

Distance between wires. Inches. (1)	Values of x per mile of wire (B. & S. gage). 60 cycles (2) No. 2 B. & S.	(3) No. 0000 B. & S.	(4) Average Value of x single-phase.	(5) three-phase.	25 cycles (6) No. 2 B. & S.	(7) No. 0000 B. & S.	(8) Average value of x single-phase.	(9) three-phase.
72	....	....	....	....	0.67	0.61	0.64	0.32
60	1.56	1.41	1.49	0.74	0.64	0.58	0.61	0.30
36	1.43	1.28	1.35	0.67	0.59	0.54	0.56	0.28
30	1.38	1.24	1.31	0.65	0.57	0.52	0.55	0.27
24	1.33	1.19	1.26	0.63	0.55	0.50	0.52	0.26
18	1.27	1.12	1.19	0.59	0.52	0.47	0.50	0.25
12	1.16	1.02	1.09	0.55	0.48	0.43	0.45	0.23

Values of x per mile of wire (B. & S. gage).

	No. 0000.	No. 000.	No. 00.	No. 0.	No. 1.	No. 2.
Single-phase line.....	0.52	0.66	0.72	1.04	1.31	1.65
Three-phase line.....	0.26	0.33	0.36	0.52	0.65	0.82

Examples of the calculation of different transmission lines, where the voltage drop per cent is known and the size of the wire is sought, are given further on.

Suppose, now, that the e.m.f. at the receiving end and the size of the wire are given, and that we wish to determine the e.m.f. at the generator end. This e.m.f. will be the hypothenuse of a right triangle, the sides of which are:

$$v \cos \Theta + r$$
$$v \sin \Theta + x$$

and, consequently, as x and r are given, it is easy to draw or to calculate the value of v_0 and the voltage regulation.

The most interesting cases, however, and the most numerous, are those where the size of the wire is sought, and, for this reason, the treatment below will be confined to such examples.

EXAMPLE I.—SINGLE-PHASE LINE.

Transmitted power, kw	250
E.m.f at the receiving end, volts	2,000
Distance of transmission, miles	19
Power factor	0.80
Frequency, cycle per second	60
Distance between wires, inches	18
E.m.f. drop	0.23

To find the size of the wire calculate, first, the current $\frac{250{,}000}{2000 \times 0.80} = 156.25$ amp; the e.m.f. v at the receiving end per mile per ampere $= \frac{2000}{1.9 \times 156} = 6.75$ volts; the e.m.f. v_0 at the generator end per mile per ampere $= 1.23 \times 6.75 = 8.32$.

From column 4 of the table we obtain the average value of x for wires at a distance of 18 in. as 1.19 ohms. This gives

$$\sin \Psi = 0.812 \times 0.6 + 0.143 = 0.63$$
$$\cos \Psi = 0.775$$

r (per mile of line) $= 8.32 \times 0.775 - 6.75 \times 0.8 = 1.04$.

Use should, therefore, be made of No. 0 B. & S. wire.

Example II.—Single-phase line with $\cos \Theta = 1$ and a frequency of 25 cycles. By using Professor Herdt's chart, the line current at 2000 volts is found to be $\frac{250{,}000}{2000} = 125$ amp; line drop 23 per cent of 2000 volts = 460 volts; line drop per mile per ampere $\frac{460}{19 \times 125} = 1.935$ volts, and, consequently, one should use No. 3 B. & S. wire. If the size of the wire be calculated with the help of the above formula, the e.m.f. v at the receiving end per mile per ampere is $\frac{2000}{19 \times 125} = 8.43$ volts. The voltage v_0 at the generator end per mile per ampere is $1.23 \times 8.43 = 10.35$ volts.

Since x taken from the above table is 0.5 ohms,

$$\sin \Psi = \frac{0.50}{10.35} = 0.0483$$
$$\cos \Psi = 1.00$$

r (per mile of line) $= 1.92$ ohms.

THREE-PHASE LINES.

In the calculation of three-phase lines, the line is generally

*One must distinguish clearly between the charts intended for the calculation of lines, where the reactance alone is considered and the capacity neglected, and the method indicated by different authors for calculating lines with reactance and capacity. The former cannot be used for long distance lines with very high tension. Dr. Pender recently pointed out in the *Electrical World* a method for such calculation, the principle of which method was laid down in 1906 by Blondel in *La Lumière Electrique*.

treated as being replaced by a single-phase line which transmits half the power at the same e.m.f. The three-phase line may also be considered as replaced by three single-phase lines, transmitting the same power; one conductor of each is similar to each of the conductors of the three-phase line, while the other has zero resistance.

It is easy to see that the e.m.f. drop is the same in the two cases.

Let V_1 be the voltage between wires of the three-phase line.

I_1 the amperes in each wire.

$\cos \Theta_1$ the power factor of the transmitted power.

Half of the power transmitted by the single phase will be:

$$\frac{\sqrt{3}}{2} V_1 I_1 \cos \Theta_1$$

With the e.m.f. V_1 between wires, the current will be,

$$I_1' = \frac{\sqrt{3}}{2} I_1$$

and the voltage drop

$$[V'] = [I_1' z'] = \left[\frac{\sqrt{3}}{2} I_1 z'\right]$$

In the case of a single-phase line with an assumed return circuit of zero resistance, the e.m.f., here called "star tension," is $V_1'' = \frac{V_1}{\sqrt{3}}$, while the current in the wire is I_1.

The e.m.f. drop is $[V''] = I_1 z'' = [\frac{1}{2} I_1 z']$; the same, therefore, for the *same e.m.f.* as in the preceding case.

For three-phase lines, replaced by a single-phase line transmitting *the same power*, one-half of the values of r and x corresponding to single-phase lines would be taken; the values of x are given in columns 5 and 9 of the preceding table.

Example III.—Assume a three-phase line with the following data:

Transmitted power, kw	4,300
E.m.f. at the receiver, volts	30,000
Distance of transmission, miles	27
Power factor of the receiver	0.70
Frequency, cycle per second	25
Distance between wires, inches	24
Voltage drop	0.16

The "star e.m.f." is $= \frac{30{,}000}{\sqrt{3}} = 17{,}300$ volts; the "star current" is $= \frac{4{,}300{,}000}{\sqrt{3} \times 30{,}000 \times 0.7} = 118.5$ amp; the "star e.m.f." at receiver per mile per ampere $= \frac{17{,}300}{27 \times 118.5} = 5.42$ volts; the "star e.m.f." at the generating end per mile per amp $= 1.16 \times 5.42 = 6.29$ volts.

Since

$$x = 0.26$$

$$\sin \Psi = \frac{5.42}{6.29} \times 0.712 + \frac{0.26}{6.24} = 0.654$$

$$\cos \Psi = 0.755$$

r (per mile of wire) $= 6.29 \times 0.755 - 5.42 \times 0.7 = 0.95$,

and consequently No. 2 B. & S. wire will be used.

It is seen, therefore, that with the help of the above table and formula (1) and (2) one may calculate accurately the size of wires for all lines with induction reactance (ignoring capacity) as well as for all power factors.

The Recent Magnetic Storm.

During the magnetic storm of Sept. 25 which seriously affected the telegraph service in America and Europe, the recording instruments at Kew Observatory were violently agitated. During the disturbance there was an almost uninterrupted succession of large oscillatory movements in the magnetic curves, especially those of declination and horizontal force. When the storm was at its height the oscillations exceeded the width of the photographic paper on which they were recorded and the maximum intensity, therefore, could not be measured. Underground cables and wireless telegraphy did not suffer, according to *Engineering*, of London. It is a noteworthy fact that wireless operators on steamers at sea were not aware of any unusual magnetic conditions.

Determination of the Constants of Instrument Transformers.

By P. G. Agnew and T. T. Fitch.

THE determination of the ratio and phase angle of instrument transformers is an important problem, and one in which considerable precision is required for technical work. The principle of the method here described is the same for both series and shunt transformers, being an application of the potentiometer method. The present article is based on a paper on this subject presented at the Washington meeting of the American Physical Society.

SHUNT TRANSFORMERS.

If a non-inductive circuit of high resistance be connected in parallel with the primary of the transformer, the secondary voltage may then be applied to it potentiometer fashion, as shown in Fig. 1, by connecting one terminal in a reversed

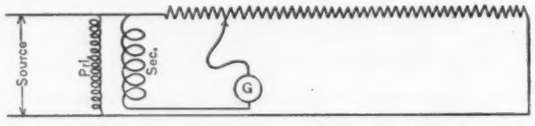


FIG. 1.—POTENTIOMETER SLIDE FOR TESTING SHUNT TRANSFORMER.

sense to one end of the resistor and applying the other terminal, through a detector G, to the resistor. If there were no phase difference between the primary and secondary voltages, a point could be found at which no current would flow through the detector. But, in general, there is a phase difference, so that the e.m.f. at the terminals of G can only be reduced to a minimum value Q, Fig. 2, which is in time-quadrature with the primary e.m.f. If, then, use were made of an idiostatic voltmeter that would read to 0.001 volt with an accuracy of 1 per cent or 2

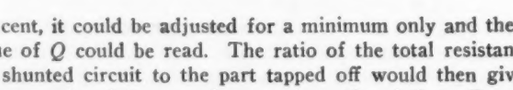


FIG. 2.—VECTOR DIAGRAM FOR TERMINAL E.M.FS.

per cent, it could be adjusted for a minimum only and then the value of Q could be read. The ratio of the total resistance of the shunted circuit to the part tapped off would then give the voltage ratio of the transformer, the ratio of Q to E_s, giving sin Θ. However, as such an instrument does not seem to be available, some more indirect method has to be used. The method first tried by the authors was to balance the small quadrature component Q, using as a source of e.m.f. a second phase from a two-phase machine, and making use of a tele-

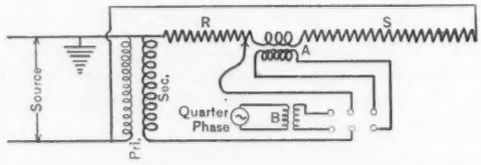


FIG. 3.—DIAGRAM OF CONNECTIONS FOR POTENTIAL TRANSFORMERS.

phone as a detector. The low frequencies and the capacity effects of the various parts of the circuit reduced the accuracy on account of the greater sensitiveness of the telephone to the harmonics present. Either a thermo-galvanometer or a vibration galvanometer gave greater accuracy, but neither was satisfactory as regards ease of manipulation. A method considerably more accurate is to use a vibration galvanometer and only a single source of e.m.f., placing variable inductances in the two parts of the high-resistance circuit and alternately adjusting the resistances and inductances for zero deflection and then calculating the difference in the phase angles by which the e.m.f. leads the current in the two parts of the high-resistance circuit.

The method finally adopted as most satisfactory was to use as detectors two electrodynamometers A and B (Fig. 3). The field coil of one was placed in series with the high resistance, while the field of the second was energized by a quadrature current from a two-phase machine. The operation is to throw the switch to the right and adjust R for no deflection. The

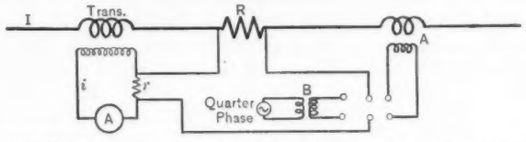


FIG. 4.—DIAGRAM OF CONNECTIONS FOR CURRENT TRANSFORMERS.

current in the moving coil is then not necessarily zero, but is in time-quadrature with that in S. Then throw the switch left and read the deflection which measures the quadrature component Q. The first setting gives the ratio

$$\frac{E_p}{E_s} = \frac{R+S}{R}$$

while the deflection of the second dynamometer gives the sine of the time-phase angle

$$\sin\ \Theta = \frac{Q}{E_s}$$

With the instruments used in obtaining the ratio and phase-angle curves shown below, about 0.05 amp was drawn through

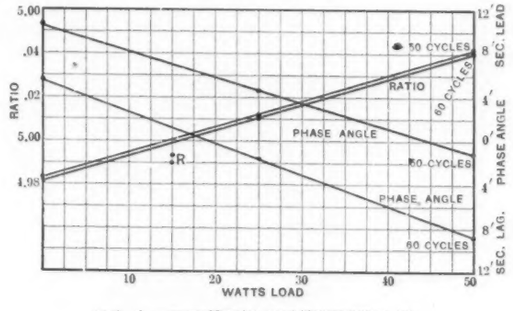


FIG. 5.—POTENTIAL TRANSFORMER M_1.

$R+S$, and a constant current of 0.5 amp maintained in the field of the quarter-phase dynamometer. For the safety of the operator the point of connection of the two transformer windings was connected to earth, and the portion S put out of reach.

The chief objection to this method is that the instrument draws a very small current from the network of conductors, and hence for the phase-angle measurement must be calibrated as a voltmeter under the conditions of use. This is easily accomplished by keeping a circuit of known resistance in series with the field coils of the quarter-phase dynamometer, with a

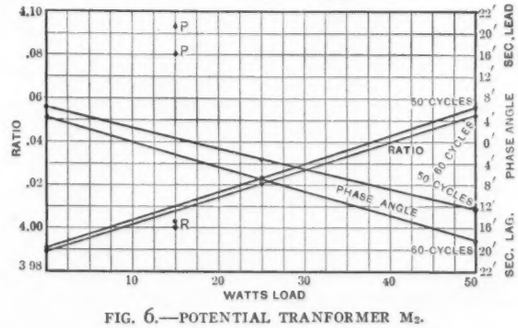


FIG. 6.—POTENTIAL TRANFORMER M_2.

switch so that the e.m.f. at its terminals may be impressed upon the potential circuit, while the transformer is disconnected from the source. At first sight it would seem that the multiplier should be R only (Fig. 3). But analysis shows, as seems evident from a close study of the figure, that R and S are in parallel, so that for calibration they are so connected.

This two-dynamometer method has the advantage of giving a uniform scale, practically independent adjustments for the two settings, a high sensibility, and the ratio can be determined at zero load on the secondary. The correction factor for any slight departure from exact time-quadrature of the field in the second dynamometer is inappreciable except for the most pre-

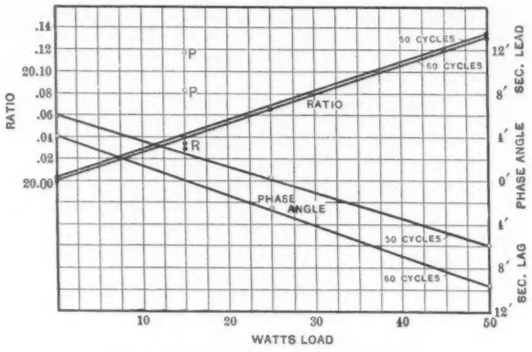


FIG. 7.—POTENTIAL TRANSFORMER N.

cise measurements, in which case the adjustment may either be made or easily corrected for.

Analysis also shows that if the time-constants of R and S differ sensibly, due to the inductance of the dynamometer and the residual reactances of the resistors, a small correction, equal to the phase difference between the e.m.fs. at the terminals of R and of $R+S$, must be applied. With high-grade resistors the time-phase angle will usually not exceed one minute.

With the instruments used, the maximum sensibility was one part in 20,000 in ratio and about 0.1 minute in phase angle, but the absolute accuracy is, of course, less, being limited by the accuracy of the resistors of high resistance in the ratio determination and by the residual reactances in the multipliers in the determination of the phase angles.

The method has been compared with three others, and the results agree within the accuracy attainable by the other methods.

In Figs. 5, 6, 7 and 8 are shown load curves of typical shunt transformers designed especially for use with measuring instruments, from different makers. The full-line curves are for non-inductive load, while the isolated points shown in some instances are for the highly inductive load of the potential coil of a watt-hour meter, being plotted in volt-amperes for comparison.

DIFFERENTIAL TEST.

The same method may be used to determine differences in ratio and in phase angle between the transformer under test and a second one used as a standard, by putting their primaries in parallel on the same source and measuring the ratio of their secondary voltages and the phase angle between them. This method avoids the necessity of working on the high-voltage

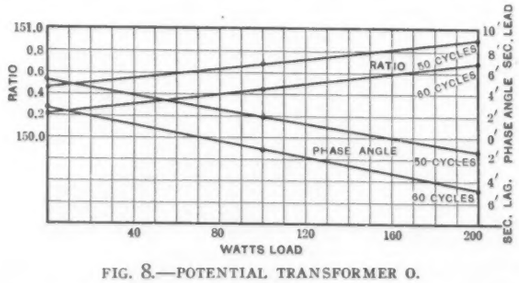


FIG. 8.—POTENTIAL TRANSFORMER O.

side. The sensibility goes up enormously because the resistance S is here reduced to a few ohms, thus lowering the resistance in series with the moving coil of the dynamometer. With the same instruments the sensibility, when used differentially, was a part in a million in ratio, and 0.05 minute in time-phase angle, though, of course, the *absolute* accuracy is not at all increased.

In fact, by using the pivoted movements of portable dynamometer voltmeters an accuracy greater than is needed in any technical work may be obtained. Hence the use of standard transformers whose ratios and phase angles are to be determined once for all is proposed.

SERIES TRANSFORMERS.

The problem of the series transformer has been a more difficult one, for the resistance and inductance of a sensitive instru-

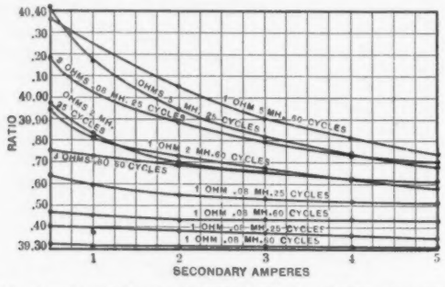


FIG. 9.—CURRENT TRANSFORMER A. RATIO CURVES.

ment placed in the secondary circuit will change both the ratio and the time-phase angle very appreciably, so that results thus obtained do not correspond to the conditions of use. However, the same potentiometer principle used in the case of the potential transformer may be applied. An electrodynamometer and a non-inductive circuit of low resistance R (Fig. 4) are placed in series with the primary of the transformer, and a second non-inductive circuit r of resistance of such a value that r/R is approximately the ratio of transformation, is placed in the secondary circuit. The potential terminals of these resistors are joined so as to oppose the e.m.fs. impressed upon them,

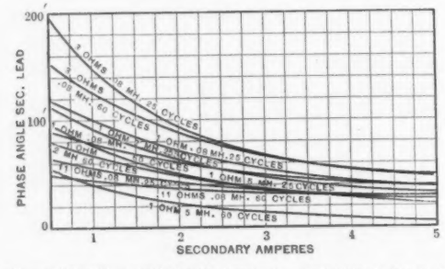


FIG. 10.—CURRENT TRANSFORMER A. PHASE-ANGLE CURVE.

the leads being brought to a double-throw switch so that the resultant e.m.f. may be applied to the moving coil of either the series or of the quarter-phase instrument. The switch is thrown to the right and r is adjusted (by shunting) to give no deflection. This arrangement gives the ratio of the currents. The switch is then thrown to the left and the component of e.m.f. in time-quadrature Q is measured by deflection. This reading gives the time-phase angle, since

$$\tan \Theta = \frac{Q}{IR}$$

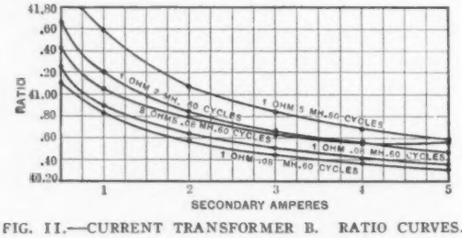


FIG. 11.—CURRENT TRANSFORMER B. RATIO CURVES.

When the time-phase angle is large it must be taken account of in calculating the ratio. By analogy from Fig. 2,

$$\frac{I}{i} = \frac{r}{R} \cos \Theta.$$

However, for most work the correction due to the cosine factor may be neglected as it amounts to less than 1 part in 6000 for a time-phase angle of 1 deg. and is only 1 part in 1000 at 2.5 deg. Theoretically, the same correction should apply to the shunt transformer measurements, but with good transformers it is entirely insignificant.

For the most accurate work the moving coil of the series dynamometer should be set at the point of zero mutual inductance, and that of the quarter-phase dynamometer worked as near the point of zero mutual inductance as practicable. Moreover, considerable care must be taken to keep the leads twisted together to avoid induction from stray magnetic fields.

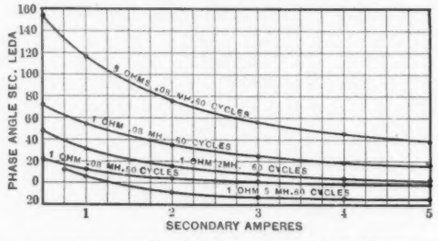


FIG. 12.—CURRENT TRANSFORMER B. PHASE-ANGLE CURVES.

With the dynamometers used a maximum sensibility, in the case of good transformers at full-load current, of about 1 part in 20,000 in ratio and 0.1 minute in time-phase angle was obtained by using from 0.1 volt to 0.4 volt drop in the shunts; of course, the final accuracy is less. This arrangement requires only a few hundredths of an ohm to be placed in the 5-amp secondary of the transformer, which value is comparable to the resistance of connecting leads as ordinarily used. The energy necessary to operate the instruments is taken chiefly from the primary instead of from the secondary.

As the sensibility in making the ratio settings varies inversely as the square of the current, dynamometers having two

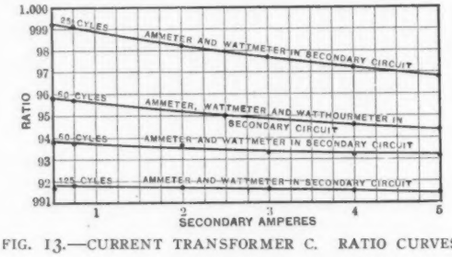

RATIO
AMMETER AND WATTMETER IN SECONDARY CIRCUIT
AMMETER, WATTMETER AND WATTHOURMETER IN SECONDARY CIRCUIT
AMMETER AND WATTMETER IN SECONDARY CIRCUIT
SECONDARY AMPERES

FIG. 13.—CURRENT TRANSFORMER C. RATIO CURVES.

current ranges were ordinarily used by the authors in order to keep up the sensibility at low loads. The sensibility of the measurement of the time-phase angle varies inversely with the load.

The multiplier of the quarter-phase instrument was usually adjusted to give a deflection of 1 cm per millivolt.

A correction must be applied to the time-phase angle measurement, due to the inductances of the shunts. The quarter-phase instrument can readily be used to compare the inductances of two shunts and if one of them is of a form such that its inductance can be calculated it may be used as a standard

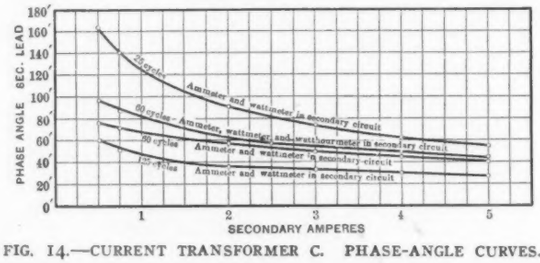


FIG. 14.—CURRENT TRANSFORMER C. PHASE-ANGLE CURVES.

and others determined in terms of it. The resistance in the secondary circuit r may be made sensibly non-inductive, but the inductances of the heavier shunts R, together with the very low resistances, give measurable values of lag—from 1 minute to 10 minutes at 60 cycles.

In Figs. 9 to 14 are shown ratio and time-phase angle curves for different characters of secondary load.

EFFECT OF MAGNETIC HISTORY.

It does not seem to have been before noted that both the ratio and the time-phase angle of a series transformer may be changed by the past magnetic treatment the core has received.

If a direct current of full-load value be passed through either winding, the flux rises to an abnormally high value, and when the circuit is broken the iron does not return to a neutral state, but is left in a state in which its differential permeability is less. Hence, when it is again used to measure an alternating current, it draws a higher magnetizing current than before, and both its ratio (primary to secondary current) and its time-phase angle are increased. The effect is precisely the same when the secondary is accidentally open-circuited while alternating current is passing through the primary, although the amount by which the calibration curves will be shifted depends upon the point in the cycle at which the circuit happens to be

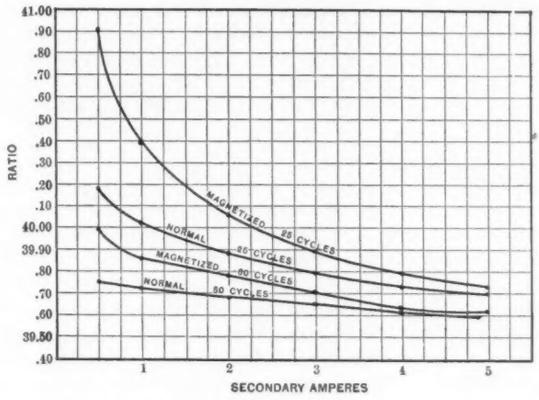


FIG. 15.—EFFECT OF MAGNETIC HISTORY ON PHASE ANGLE OF SERIES TRANSFORMER A.

closed. Figs. 15 and 16 show the effect of such treatment in raising the entire curves, both of ratio and of time-phase angle.

This effect has been found to be very appreciable in every transformer investigated, and is also present with every condition of secondary load. As indicated by theory, it is greater the greater the impedance in the secondary circuit, and, as theory also indicates, it decreases as the load increases. The change

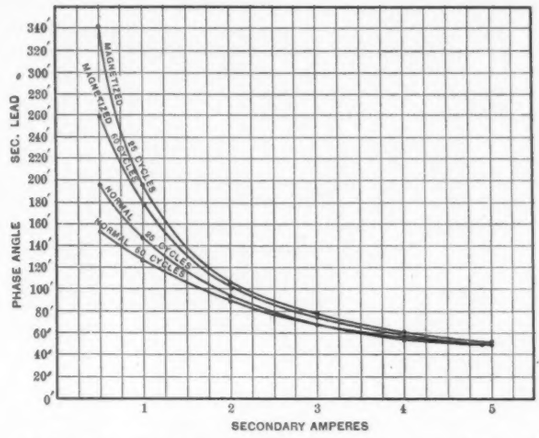


FIG. 16.—EFFECT OF MAGNETIC HISTORY ON PHASE ANGLE OF SERIES TRANSFORMER A.

in ratio at full load is nearly always about 0.1 per cent, but at one-tenth load it may be anywhere from ½ per cent to 5 per cent or 10 per cent, depending upon the quality of the transformer core and the amount of resistance and inductance in the secondary.

This is, no doubt, a frequent source of serious error in measurements requiring the use of series transformers. It is clear that the secondary of a series transformer should never be open-circuited while current is passing through the primary, and that the direct current used in calibrating standards, sometimes employed with them, should not be allowed to pass through the transformer, as is sometimes done.

Fortunately the effect may be entirely removed, in case the secondary has been accidentally open-circuited, by demagnetizing the core. This may be conveniently done by opening the secondary, passing full load, or an overload alternating current through the primary and continuously reducing it to zero.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Electric-Power Booklets.

The Central Georgia Power Company, as noted previously, is issuing a series of "booklet" talks to users of electrical energy, written by Mr. J. J. Cagney, manager. The second one of the series, just issued, is entitled "The Trend of the Times," and presents the advantages of electric power to workshops, mills and factories. The booklets are tasteful in design, and in very readable form set forth the arguments in favor of the use of electricity as a motive power.

Holland (Mich.) Municipal Plant.

The annual report of the board of public works of the city of Holland, Mich., on the operation of the municipal central station plant of that city, is a model for the class of plants considered. More than a dozen tables give very complete information on the financial and operating conduct of the plant, together with comparative statements of receipts, disbursements, equipment and cost of production from the commencement in 1894 to the present year. Among the expenditures are entered $1,000 for estimated loss of taxation and $8,547 for depreciation. The total investment in the plant to date is $166,273, against which a total of $57,270 has been charged off for depreciation. The outstanding bonded indebtedness is $74,000. The rate of depreciation applied is 5 per cent for buildings, 6 per cent for station equipment and meters, and 10 per cent for distribution system. The average annual load factor of the plant is 34.8 per cent. The average loss in transmission between generators and customers' meters is 15 per cent for both lighting and power, the figures separately being 23 and 11.9 per cent, respectively. The average coal consumption is 6.51 lb. per kw-hour of output. The rated capacity of the plant is 925 kw; the maximum load at present is 600 kw, and the total connected load is 2232 kw. The cost of production in detail is given under 25 heads.

Electricity at Halloween.

A suggestion for Halloween parties is the use of the electric cornpopper. By the use of this device corn may be popped in a parlor, if desired, by connecting the popper to an incandescent lamp circuit and rolling it back and forth on a table. This should constitute something of a novelty in a party of young people. Festoons of colored miniature incandescent lamps can be used for decorations, and even the grinning jack-o'-lantern may be illuminated by an electric lamp. These suggestions are made by the Commonwealth Edison Company, of Chicago, and may be of general interest.

Meter Rate Obligatory in Pasadena, Cal.

The City Council of Pasadena, Cal., has passed unanimously an ordinance forbidding flat-rate charges for central-station energy, and requiring the central-station company to install meters for all customers. The ordinance also establishes maximum rates as follows: Up to 100 kw-hours per month, 11 cents; 100 to 500 kw-hours, 10 cents; 500 to 1000 kw-hours, 9 cents; 1000 to 2000 kw-hours, 8½ cents; over 2000 kw-hours, 8 cents.

An Echo of the Street Railway Convention.

Denver has a famous street-car line which is all down hill one way. The horse which pulls the car up hill rides on one platform on the down trip. During the recent street-railway convention at Denver members of the new-business department of the Denver Gas & Electric Company saw an opportunity for a timely bit of local advertising and at the same time contributing something to the entertainment and amusement of the visiting street-railway men. They temporarily chartered this car, put it on a flat car of the Denver City Tramway Company and had it hauled around the downtown streets by a motor car. The appearance of this odd-looking outfit is shown in the accompanying engraving. Secretary C. N. Stannard, of the Denver Gas & Electric Company, is acting as conductor on the rear platform. Members of the new-business department dressed as various characters and a negro quartet to keep things lively form the supporting army. It is needless to say that this strange outfit attracted plenty of attention. The picture tells the rest of the story.

AN ANCIENT STREET CAR AT THE DENVER CONVENTION.

Selling Electricity.

At the convention of the Colorado Electric Light, Power and Railway Association at Denver, Oct. 7, Mr. H. McConnell, of the Colorado Springs Electric Company, presented a paper on selling electricity in which the following suggestions were offered for cities of from 10,000 to 50,000 population:

In the author's opinion much business can be obtained for a central station through newspaper advertising. He does not mean by this that a central station should tie itself up with a newspaper to take a specified amount of space each month, but when the company has any special appliances or a demonstration to advertise, the company should go to the paper, instead of having the advertising manager of the paper appear at the company's office every morning with that stale question: "Have you to-day's ad ready?" with the consequent feeling which often comes: "Well, we have contracted for it, so I suppose we have to take it." With this system one advertises because he thinks he must and not because he thinks it is going to do him any good.

Of the salesmen the one whose task is the hardest is the "power" salesman. One important characteristic should be part of his make-up, and that is, enthusiasm. He should possess so much of this that almost his every thought should be connected with his work. When he goes into a factory operated with other than central-station energy, he must have clearly in mind the exact way to connect the motor with the peculiar kind of mechanism used in that factory. He must be ready to adapt his company's services to the peculiar needs of the factory, always keeping in view the main idea of economy for the company as well as for the customer. While looking over the plant he must carefully make notations of the actual time the machinery is running at its maximum and its minimum capacity and then carefully weigh in his mind what load factor will apply. Then he should go to the shop foreman and obtain from him some idea of the average number of hours the plant is operated and, generally, by this time, he will be surprised at the small amount of energy used. Next he should get his selling points together in order to show why this factory should become a central-station customer so that, when he leaves the factory for the office, he can let his imagination drift to such an extent that he can already hear the hum of the motors in the factory. When, however, he enters the prospective customer's office he must be careful to appreciate the customer's position in the matter. He must remember that the man with whom he is dealing has a big investment in an isolated plant and that he is trying to operate as economically as possible. The factory owner probably has heard people complain about their bills, and he may think, as do many, that the electric companies are grinding corporations. Is not this the opportune moment for central stations to install motors on a six-months' trial? The companies would certainly get their investment back in future earnings.

The increased number of electrical appliances on the market to-day is making the power salesman's path a smoother one than ever before, but few of them, in the endeavor to close down steam or isolated plants, realize what opportunities are being stumbled over. It is safe to say that in the average business block there is scarcely a business house which cannot be induced to install a motor of some kind. The druggist can use an electric drug chopper; the tailor an electric clothes cutter, and the baker an electric dough mixer; the butcher a meat chopper, and so on.

Many methods have been tried to increase sign loads, and those stations having the most success are the ones giving a flat-rate charge per month. This price, in some cases, includes the rental of the signs, lamp renewals and patrolman's service. Other stations install signs on long-time payments, and some have gone so far as to give free signs. This class of business is desirable as it enables the central station to hold a customer on a contract to burn his sign certain hours every night in the month for a term of from one to three years. It also enables the customer, by giving him a flat rate, to figure this class of business as advertising. Many companies do window lighting on this same basis.

In securing house-wiring contracts many companies have found it advantageous to allow two years' time for the final payment on wiring, the payments being on the monthly plan. In putting appliances out on trial one company met with much success by sending with every meter an electric iron on 30 days' trial, thus educating the public to an increased consumption at the start instead of waiting until the customer had paid several bills. A central-station commercial manager should not be satisfied until he has the public educated to the fact that his company is no longer the electric lighting company, but the electric company, so that when a customer applies for electricity he realizes that he is applying for something by which he is able to sew, wash, iron, clean, cook and heat as well as light his home. Many central stations overlook the fact that if the proper methods were carried out additional lighting could be taken on their city lighting contract. To get this business a middle-Western company went to the expense of donating some artistic park lighting effects for one of the small parks and it proved to be such a wonderful improvement over the old type of lighting that the city gave the company a contract to place this same effect in all of the parks and public squares, thus beautifying the city and also increasing the sale of electricity.

In the discussion on this paper Mr. Taylor, of Denver, expressed the opinion that motors placed on trial represent money well spent. Mr. H. J. Buell, of the Northern Colorado Power Company, said that the work of the new-business department should be directed so as to increase the load factor of the plant. He drew a typical load diagram on the board and showed the effect of irrigation pumping load, such as he is securing in the agricultural districts through which the lines of the Northern Colorado Power Company run. This business is taken under a contract by which the user turns off the circuit from 7 to 10.30 p. m. This is a summer load, and by such a contract it does not come on the summer peak.

Mr. George B. Tripp, of Colorado Springs, complained of the difficulty in getting automobile garages to refrain from charging during peak hours. Mr. Taylor, of Denver, said that the practice there was to issue to garages a card showing the non-peak hours and schedule of hours. The readiness-to-serve rate is $7.50 for charging at all hours and $5 for charging only during non-peak hours. The hours at which a consumer charges are followed up by inspection. Mr. C. F. Oehlmann, of Denver, said that the idea of having the meter men deliver irons to consumers had an advantage in that it took less labor than sending another man around on this errand. Some companies have been loaning irons free on six months' trial, and he questioned whether renting would not be better.

Lighting Companies' Exhibits at the New York Electrical Show.

The third annual New York Electrical Show, in Madison Square Garden, was brought to a close Oct. 21, the exhibition having been the most successful artistically and commercially ever given in New York. Inasmuch as the show was fostered by the lighting interests of the greater city, it was natural that the New York Edison Company, the United Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn should be the largest exhibitors.

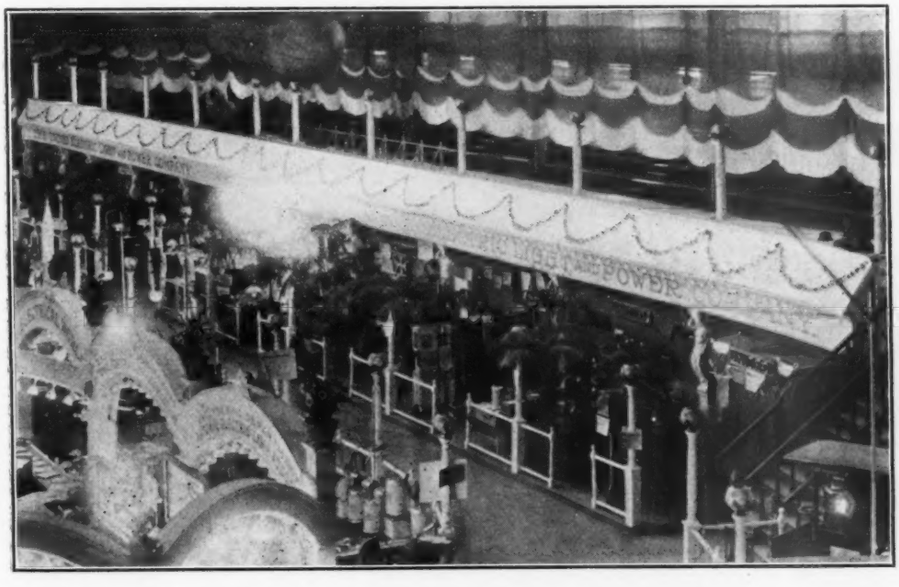


FIG. 1.—EXHIBIT OF THE UNITED ELECTRIC LIGHT & POWER COMPANY.

The exhibit of the United Electric Light & Power Company occupied the entire south side of the main floor of the Garden. The space was divided into 10 separate booths, in each of which the principal idea was to exhibit by actual display the advance which has been made in the application of alternating current within the past year. In the first booth were shown various advertising and spectacular effects with the use of alternating current, induced electrical effects, the use of transformers and other alternating-current apparatus. The second booth contained a complete outfit of alternating-current dental, X-ray and medical apparatus. Next to the medical and dental apparatus was a booth containing motion-picture apparatus, together with alternating-current types of lamps used in photographic work, blue printing and other commercial applications. In the household booth were shown practical applications of electricity used throughout the household. Included in the apparatus were electric irons, toaster sets, heaters, fans and many new devices for the convenience and comfort of the home. Carbon, tantalum, tungsten and metalized-filament incandescent lamps, arc lamps, vacuum lamps, sign lamps and the application of tungsten lamps to sign lighting were shown in a booth next to the side exit. A large ball made up of 25-watt, frosted-tip tungsten lamps, fitted with reflectors, and set on a very handsome brass pedestal, created considerable interest. Immediately below the lamp booth was the office and reception room of the company, where its customers were received and entertained. Adjoining the reception booth were shown recent developments in the commercial application of electricity for store purposes, including coffee mills, meat choppers, beer pumps, buffing machines, ice-cream freezers, exhaust fans and other applications of interest to the merchant. Among the industrial applications shown in the next booth were various electrical apparatus for use in shops, factories and commercial houses of all kinds, including cloth cutters, machine drills, jig saws, lathes, printing presses and applications of electric welding, etc. In what was termed a "construction booth" was a display of apparatus used in the construction of buildings operated from alternating current, such as electric hoists, electric drills, concrete mixers, pumps and riveters. The last booth of the company was utilized to show the advance which has been made in alternating-current elevator apparatus, a complete high-speed

FIG. 2.—ELECTRIC REFRIGERATOR AND WASHING MACHINE, BROOKLYN EDISON EXHIBIT.

alternating-current elevator motor being shown in operation.

One of the prettiest exhibits of the show was that of the Edison Electric Illuminating Company of Brooklyn, which was located at the east end of the Garden. In one corner of the

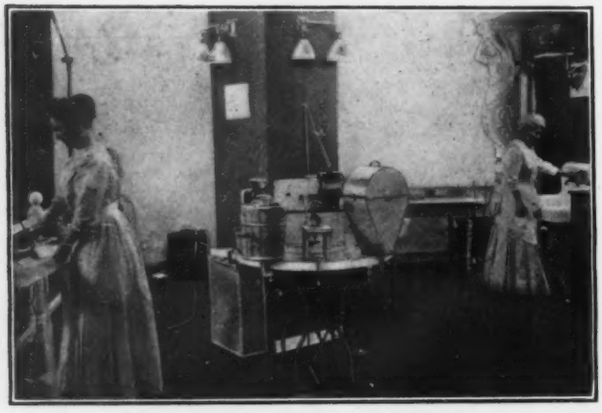


FIG. 3.—KITCHEN CORNER, BROOKLYN EDISON EXHIBIT.

space was an electric organ, and the effects which were obtained from electric flowers scattered throughout the booths added to the attractiveness of the exhibit. The aim of the Brooklyn company was to set forth all the advantages of electric housekeeping, and, although the various rooms were not shown as heretofore, all of the apparatus was on exhibition. In the kitchen and laundry were a clothes washing machine, drying machine, electric iron, electric water heater, electric range with utensils, including broiler, griddle and stoves, ice-making and refrigerating machine, electric plate warmer, electric coffee grinder, polishing machines, disk stoves, percolators and water pots.

Among the apparatus suitable for the dining-room shown in actual operation were an electric coffee percolator, a tea kettle, chafing dish, food warmer, waffle iron and toaster. For the parlor there were on exhibition an electric pianorchestra, a combination of all the different instruments used in a full symphony orchestra assembled in a single case and arranged to play in solo or concert work; an electric floral display and an electric fountain. The apparatus suitable for the bedroom, nursery and bath included electric heating pads, curling-iron heaters, baby milk warmers, hair dryers, radiators, foot warmers, massage outfits and sterilizers.

FIG. 5.—ELECTRIC FLOWERS, BROOKLYN EDISON EXHIBIT.

Among the other household appliances which were placed on exhibition were electric sewing machines, vacuum cleaners and portable lamps. Anticipating the numerous questions that might be asked regarding the various pieces of apparatus the company prepared a small pamphlet giving a description of the appliances, together with their initial cost and the cost of operating from the Edison system.

The New York Edison Company featured the application of the electric motor to industrial machinery. The company occupied the 10 booths on the north side of the Garden. The first of these was devoted to the electric signs of the Metropolitan Engineering Company. Immediately adjoining this booth was one of popular interest, in which the Cyphers Incubator Company maintained an exhibit, consisting of its electrically operated incubators hatching chickens during the show, brooders, electric hens, etc. A portion of the next booth was used by Causchois, the coffee man, who demonstrated electrically operated coffee urns to be used in restaurants. Two and one-half booths were occupied by a printing exhibit, consisting of a Whitlock cylinder press printing a sheet 36 in. x 48 in., a Dexter folder, Dexter cutter, Monitor stitcher and monotype machine. The printing press was operated during the show, turning out Edison pamphlets, the other machinery being employed in finishing them. In the booth alongside the side exit was an electric laundry equipment, with a washing machine, dryer, mangle and ironing table, all of which were used during the exhibition on flat work supplied from a neighboring hotel. Adjoining the laundry was a candy kitchen with a number of electrically operated machines used in the manufacture of various sweets. Philip Morris & Company occupied a booth where they showed a cigarette-making machine in operation, and

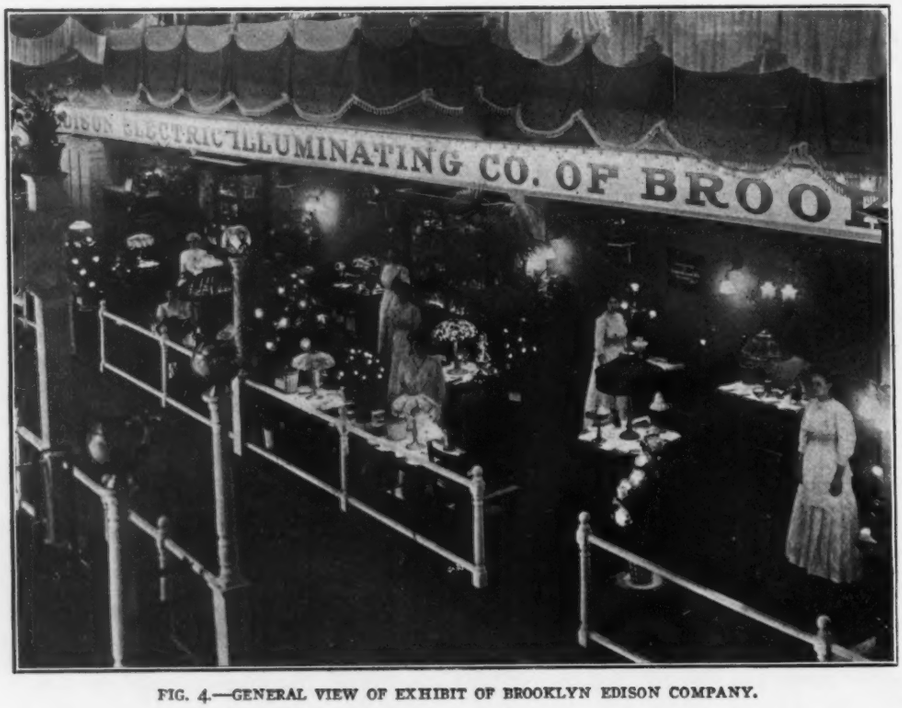


FIG. 4.—GENERAL VIEW OF EXHIBIT OF BROOKLYN EDISON COMPANY.

also a cork-tipping machine. Not the least interesting of the exhibits in the Edison space was that of the Natural Food

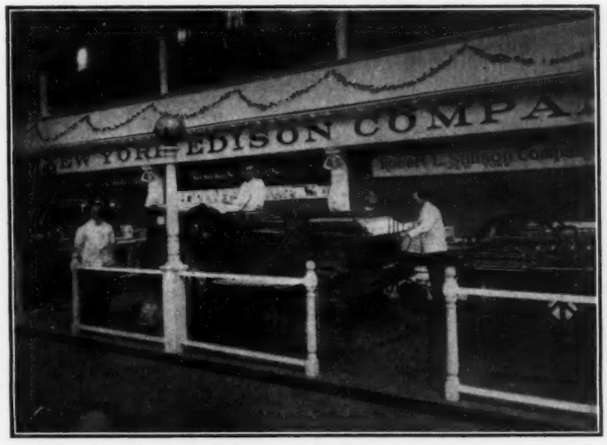


FIG. 6.—PRINTING-PRESS EXHIBIT OF NEW YORK EDISON COMPANY.

Company, which demonstrated its process of steaming, shredding and baking Triscuit. The whole wheat was first soaked

FIG. 7.—CORNER OF PRINTING BOOTH, NEW YORK EDISON PLANT.

and placed in a large bowl in the machine, then shredded by great combs. It was then baked in electrically heated forms,

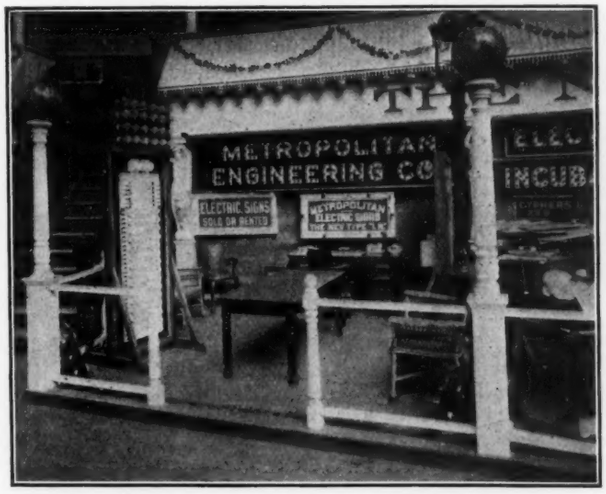


FIG. 8.—ELECTRIC SIGN BOOTH IN NEW YORK EDISON SPACE.

thus completing a remarkably simple operation. The remaining booth was occupied by Frank Brothers, embroidery manufacturers, who showed a sewing machine in operation, and also the use of electric irons for pressing the work. In the balcony the

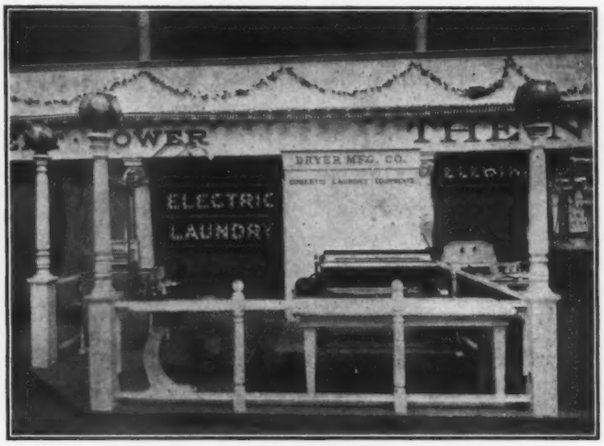


FIG. 9.—ELECTRIC LAUNDRY IN NEW YORK EDISON SPACE.

New York Edison Company had a Japanese tearoom where electric heated pots were used in brewing tea. All of the toast and cakes served were baked in electric ovens.

INTERIOR WIRING AND ILLUMINATION

Denver's New "White Way."

Seventeenth Street is the third of Denver's principal downtown streets to have special lighting. This street was equipped just in time for the recent street-railway convention. The same general plan has been used on Seventeenth Street as on the other streets. Arc lamps are suspended by ornamental brackets from each electric railway pole. Both bracket and pole are of special design approved by the Municipal Art League. The railway company changed the pole for this purpose and the bracket was paid for by the property owners along the street. The operation and maintenance of the lamps are paid for by the city. There are four of these lamps per block on each side of the street. The accompanying engraving is from a

SEVENTEENTH STREET, DENVER'S NEW "WHITE WAY."

photograph taken from one end of the street looking toward the Union Depot. The street so equipped is about a mile long.

In addition to the arc lamps temporary special festoons of colored incandescent lamps were hung on the span wires in honor of the street-railway convention. The arcs are the common carbon, enclosed type, with clear inner and opal outer globes. They are operated off a constant-potential alternating-current circuit and supplied by the Denver Gas & Electric Company.

A Large Temporary Lighting Installation.

The space required for the exhibits at the recent convention of the American Street and Interurban Railway Association at Denver was such that it was necessary to extend the Auditorium, where the convention was held, by building a large temporary annex. This annex occupied adjoining streets, which were temporarily vacated for the purpose. The lighting arrangements of this temporary building are shown in the accompanying engraving, which is from photographs taken from one corner, showing the two parts of the annex which occupied Fourteenth and Champa streets, respectively. The lighting was planned by Mr. George Williamson, one of the illuminating engineers of the Denver Gas & Electric Company. The square feet floor area aggregated 41,300, and there were 432 old-style 50-cp, 200-watt lamps equipped with extensive-type Holophane reflectors. The watts per square foot were 2.1.

TEMPORARY LIGHTING FOR DENVER STREET RAILWAY EXHIBITS.

Tungsten lamps were not used because of the danger of breakage in putting up and taking down for such a temporary installation.

Recent Progress in Illuminating Engineering.

Mr. J. R. Cravath, before the Colorado Electric Light, Power and Railway Association, Denver, Oct. 7, 1909, gave a talk on the above subject illustrated with blackboard sketches.

Three years ago the speaker gave a paper before the association on the lighting of small stores to get the best results and with the special object of meeting competition. Since that time the principles then advocated as to the use of incandescent lamps with reflectors of proper design have come into common use along with the introduction of the tungsten lamp. The speaker's object in the present talk would, he announced, be the explanation of some of the sources of loss and inefficiency, which are better understood now than a few years ago, and some of the short cuts in calculation which the increasing knowledge of illumination makes possible.

In most rooms the greatest opportunity for loss of light is by absorption by the walls. Usually the illumination of a plane about 30 in. from the floor is that taken into consideration. The light given off from a lamp in downward directions from a lamp strikes this plane directly without loss. The light which goes up toward the center of the ceiling is reflected from the ceiling to the working plane with one reflection and with small loss if the ceiling is light in color. The light which is given off horizontally from the lamp strikes the walls at such an angle that it must be reflected back and forth a large number of times between the walls before it reaches the working plane. Every reflection involves loss. A large percentage of the total light given out by an ordinary tungsten lamp is within a zone 30 deg. from the horizontal. If, therefore, this light is used inefficiently by directing too much to dark walls to be absorbed by multiple reflections the total efficiency will be low.

The bearing of this fact on practical work is to prohibit the use in most places of a flat type of reflector for incandescent lamps. This includes the flat reflectors used on clusters and the old distributing type of reflector first introduced with Gem lamps. These flat reflectors are not only wasteful because of the light which is absorbed by the walls of a room, but also because the lamp is so exposed that it blinds the eye and renders inadequate the illumination in many places where it would be sufficient were not so much glare present.

It has been found possible to design reflectors which will direct a large percentage of the light of a lamp downward at such angles that it strikes the working plane without the loss by reflection from one or more walls. Such reflectors as now made cover the lamp so as to intercept the horizontal rays and also to protect the eye of the user of the room from the glare of the unshaded filament. In the use of such reflectors the principal danger to be avoided is the use of a reflector giving a broad or extensive type of distribution in high narrow rooms where a large amount of light will be directed to dark walls where it will be lost. Concentrating reflectors should be used in such rooms when the outlets are close to the walls.

Another thing that has been learned from theory and experience the past few years is the fact that in lighting a large interior with a large number of lamps equipped with reflectors, the height at which the lamps are placed has very little influence on the efficiency as measured in foot-candles. On the other hand, it is desirable to hang lamps as high as possible to get them out of the range of vision so that they will interfere least with seeing clearly.

Indirect lighting in its latest improved form is coming into use where comfortable illumination is desired. Most of the indirect lighting installations of years past have been by placing the lamps in a cove around the sides of the room. Most of these were inefficient because the light from the lamps struck the ceiling at such an angle that instead of being directly reflected to the working plane it had to be reflected first from the ceiling to a wall, then back to another wall and so on, finally

reaching the working plane after many reflections with much loss at each reflection.

Indirect lighting as applied recently by inverted reflectors placed on chandeliers in the center of the room directs much of the light from the lamp to the ceiling at such an angle that it is reflected down to the working plane directly from the ceiling and hence with minimum loss. One of the greatest advances in the past three years, however, has been in the increasing amount of definite knowledge that is now available as the result of tests on actual installations. The speaker gave the accompanying table for use in calculating illumination. He stated it to be compiled from such tests as are now available on actual installations. The figures are approximately correct for a large number of every-day cases, but there are many things which will influence the results.

Size Room.	Height.	Color—Ceiling.	Color—Walls.		Watts per Lumen*
50′ x 50′	10′ to 20′	Light	Light	Clear	0.20
50′ x 50′	10′ to 20′	"	Dark	"	0.25
15′ x 15′	8′ to 12′	"	Light	"	0.23
15′ x 15′	8′ to 12′	"	Dark	"	0.30
15′ x 15′	8′ to 12′	"	Light	Indirect; mirror reflectors	0.35
15′ x 15′	8′ to 12′	"	Dark	"	0.45

* The foot candles desired should be multiplied by this figure to get the watts per sq. ft. required.

The figures apply to installations which are clean and fairly new. A loss of from 5 to 35 per cent for dirt and depreciation should be allowed and the dirt floating in the air and the frequency of cleaning should be taken into account.

Working on Live High-Tension Lines in the Black Hills.

The linemen of the electrical transmission companies operating in the Black Hills in the mining district of South Dakota are accustomed to work on high-tension lines in a way that would fill an Eastern operator with astonishment. The climate is dry, so that the poles become good insulators. It is hardly necessary to say that live lines are not worked upon unless the weather is dry and has been so for some time.

The Black Hills Traction Company, for some time under the management of Mr. F. P. Wood, has 24,000-volt lines which are used for transmitting energy from a hydroelectric plant and distributing it over the mining district. It is the custom of linemen to renew insulators and do other work on the live 24,000-volt lines without the use of any insulating devices whatever. Figs. 1 and 2 show a lineman working on such live lines. As seen from the position of the wires in Fig. 1, the pole is on a steep mountain slope. Fig. 2 shows a lightning-arrester station being equipped with horn-gap arresters. The separation of the wires on this line is 5 ft. The men work without gloves and keep a constant hold on the wire with one hand to keep the static charge drained off. Sometimes after working all day at renewing insulators and making repairs on a live line a man will have a little soreness in his ankles next to the climbers, due perhaps to the static charge passing into the climbers. Probably 500 insulators have been changed in this manner.

FIG. 1.—WORKING ON A LIVE 24,000-VOLT LINE.

At first it was the custom to form a low-resistance path around a man's body by the well-known expedient of fastening a chain or a wire part way down the pole and connecting the upper end to the line wire to be worked upon. This chain drains off the static charge and precludes the possibility of dangerous current leaking through the man's body and down the pole. However, the workmen on these lines became tired of using the jumpers because they did not seem to be necessary, and work is now done without them.

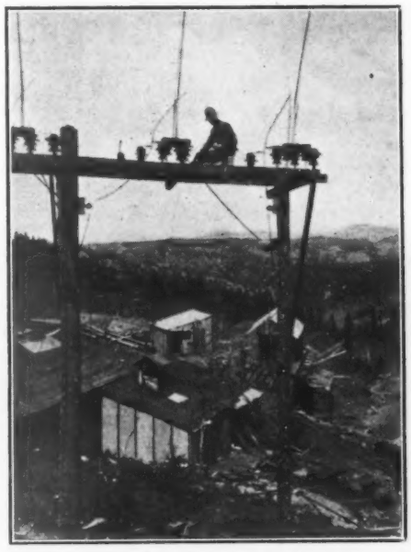


FIG. 2.—ARRANGING HORN ARRESTERS ON A 24,000-VOLT LINE.

On the 11,000-volt lines of the Consolidated Power & Light Company, operating in the same district, insulators are renewed on live lines, but additional precautions are taken. Linemen wear rubber boots and rubber gloves and do not touch the wire, but use pliers insulated with linen varnished tape. The tape is much better than rubber in the climate of South Dakota as it does not dry out.

A Structural Steel Transmission Bent.

By H. V. Hodgman.

Coincidental with the rearrangement of feeder circuits radiating from an industrial-plant generating station it became necessary to carry a group of wires and a telephone cable across a river which intersected the property of the company. The installation of a terminal tower on each side of the stream was first considered, but this method was abandoned as some of the conductors were quite large and it was considered that the installation and repair of these would prove difficult. Furthermore, the cost of the two towers, which of necessity would be quite high and of sturdy construction, was excessive. It was finally decided to convey the conductors across on steel bents to be riveted to the struts of a steel bridge which crossed the river at a convenient point.

The bridge is shown diagrammatically in Fig. 1. There were actually more panels in the bridge than indicated, but the diagram makes clear the arrangement of bents and the method of attachment. A complete bent is detailed in Fig. 2. It is built up entirely of structural steel sections and plates held together with rivets and was designed for riveting to a vertical post or strut of the bridge. The posts (shown in a dotted line in Fig. 2) were each made up of two 6-in. x 8-in. channels arranged back to back and bound together with strap steel lattic-

ing; the rivet holes for the lattice bars being 8¼ in. apart horizontally. In laying out the bent, the holes in the 3-in. x 5-in. angles, forming the left-hand vertical of the bent, were made to correspond to this spacing and to the corresponding vertical spacing. The 5/16-in. plate taking the thrust of the

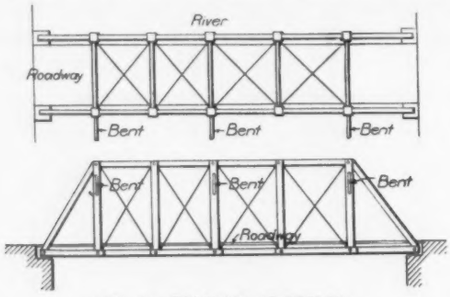


FIG. 1.—DIAGRAM OF BRIDGE.

diagonal brace was also drilled to coincide with the lattice-bar rivet holes. In attaching the bent to the post it was merely necessary to remove the lattice bars and rivet the bent to the strut members, using the old rivet holes.

All gusset plates were ½ in thick, this thickness being chosen so that the slots between members, determined thereby, would accommodate the 7/16-in. bolts used for securing the telephone cable support (Fig. 3) and the steel insulator pins (Fig. 4). The two lower gusset plates on the outer end of each bent were allowed to project ½ in. to form a shoulder to take the vertical thrust of the telephone cable support. In the lower plate two 11/16-in. holes were punched for the future accommodation of ⅝-in. tie rods, terminating at their inner ends on the bridge structure, in case the installation of such was ever deemed necessary to prevent swaying of the bents.

Fig. 3 is a detail of the telephone cable support which was formed from ½-in. x 2-in. wrought-iron bar. Half-round grooves were forged in the clamping plate and in a correspond-

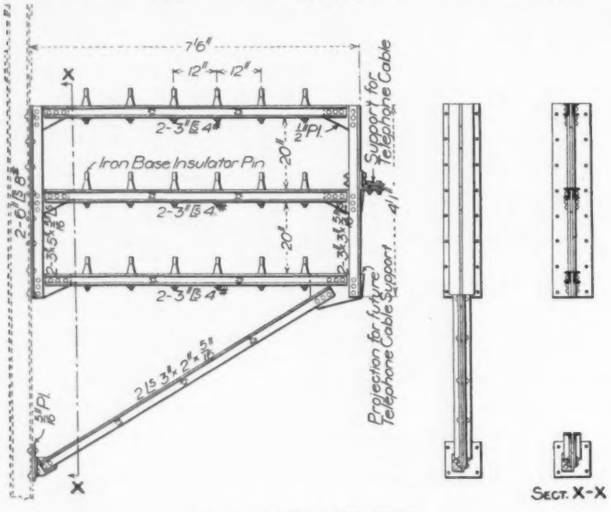


FIG. 2.—DETAILS OF BENT.

ing location in the L-shaped supporting member. A ½-in. stranded steel messenger wire, to which the telephone cable was supported with marline hangers, was clamped in these grooves, between the two members, with ½-in. bolts. Two 7/16-in. bolts, passing between the two 3-in. x 3-in. x 3/16-in. ells forming the outer vertical, held the support to the structure.

Fig. 4 shows the constructional features of the metallic insulator pin selected. This is a standard appliance purchaseable from any large dealer in electrical supplies. The top is a frustrum of wood, impregnated with a preserving compound, with a standard insulator thread turned on it. This wooden top fits into a base of galvanized malleable iron. A 7/16-in. galvanized wrought-iron bolt supplied with a punched washer serves for a stem for attaching the pin to the cross-arms of the bent. It should be noted that, as a rule, any bolt smaller than ⅝-in. diameter should be avoided in general construction as an able-bodied lineman, with a 12-in. monkey-wrench, is capable of twisting smaller bolts asunder. In the construction de-

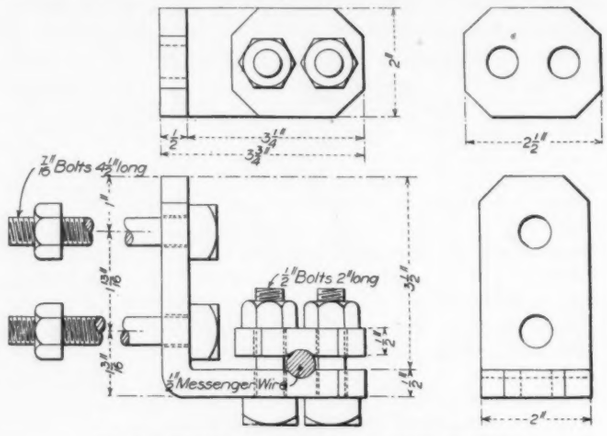


FIG. 3.—DETAILS OF TELEPHONE CABLE SUPPORT.

scribed the use of 7/16-in. bolts for both the telephone cable supports and the insulator pins was desirable to avoid excessive thickness of gusset plates and cross-arm spacing washers. These determine the width of the slots through which pin and supporting bolts must pass.

Only half of the pins were occupied at the time the bents were installed, and although pins may be easily removed from and inserted in the cross-arms, each bent was initially fitted with its full quota in order to avoid delays due to slow delivery on pins when new lines are to be strung. Inasmuch as the thread in almost all types of insulators is standard, any type that is likely to be used can be screwed on the pins.

The bents were spaced on every other bridge post (see Fig. 1), making very short sections. This was done to avoid

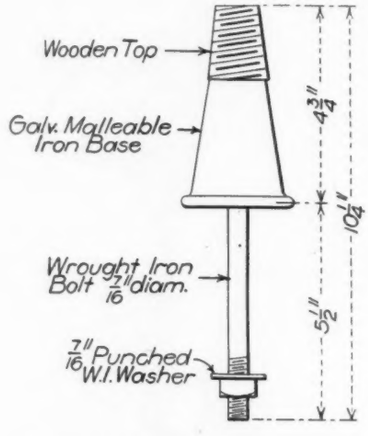


FIG. 4.—DIAGRAM OF METALLIC INSULATOR PIN.

the excessive loading of a few of the bridge posts. Each bent was thoroughly painted after erection.

Telephone Patents.

NEW ACCESSORIES.

A combined closure and antiseptic device for transmitters forms the subject of a patent granted to Mr. J. B. Burkholder, of Minneapolis, Minn. A perforated metal cap clamps over the mouthpiece, carrying a second piece with holes to register with the first and secured with a central loose rivet. It may thus be rotated to close or open the passage. An antiseptic pad behind the cap serves to disinfect the enclosure.

Messrs. K. M. Turner and H. W. Haff have patented a packet-battery casing and transmitter holder for audiphone sets. The battery casing has a pronged holder for taking the transmitter, from which, however, it may be readily removed. The circuits are made through flexible cord, all slack cord being stowed in the battery-box cover. The General Acoustic Company has been assigned this patent.

Letters to the Editor.

Effects of Third Harmonic.

To the Editor of Electrical World:

Sir:—Referring to the article by Mr. F. M. Denton in your issue of Oct. 14, entitled "Effects of a Third Harmonic in the E.M.F. Wave of a Three-phase Generator," and referring to the editorial on the same subject, I beg to offer the following comment:

Mr. Denton explains clearly in the article the effect of the third harmonic upon the e.m.f. wave form of a three-phase generator when the same is connected in star or in delta, and shows the effect by means of oscillograms in the case of a 60-cycle generator with two slots per pole per phase. In the editorial commenting upon the article it is stated that: "Designers take care to reduce the triple-harmonic frequency e.m.f. in the bars of the delta-wound armatures," etc. This is a point which might be more clearly brought out, since, although it may not be so intended by the article, it nevertheless gives the impression that the delta winding should be avoided.

The reason for the disappearance of the third harmonic from the terminal voltage in case of the star connection is that the windings of the two legs are distributed over two-thirds of the pole-pitch, or over 120 electrical degrees. In the same way can the third harmonic be eliminated in each one of the three legs, simply by "chording" the windings two-thirds of the pitch. In so doing, the winding of each leg is distributed over 120 electrical degrees instead of over 60 deg., as in case of a fractional-pitch winding, and the third harmonic will completely disappear from the voltage of each leg. In cases of new designs, and especially if for any reason delta connection is required, the winding can always be so arranged as to eliminate the triple harmonic.

In order to obtain the same e.m.f. for the winding, it is of course, necessary to increase the total number of armature conductors. This factor fixing this increase of conductors is the sine of 120/2 or 60°—namely, 0.866. That this increase in number of conductors required by the chord does not mean a sacrifice in copper or iron is a point that most designers are well aware of.

This point of eliminating the third harmonic may also be of value in connection with three-phase star-connected generators operating in parallel with grounded neutrals on account of the triple-frequency currents which may flow in the neutral connection. Similarly, it is a point worth consideration in cases of all armature windings, whatever phase or connection.

Edgewood Park, Pa. Jens Bache-Wiig.

The Lux as the Unit of Illumination.

To the Editor of Electrical World:

Sir:—In your issue for Sept. 23 there appeared an editorial comment on the standard of light in which it is stated that "rather recently some German writers have fallen into the quite inexcusable custom of adopting the term *lux* for the meter-hefner." Allow me to state that the use in Germany of the term "lux" as a unit of illumination identical with the meter-hefner is neither of recent date nor does it represent a quite inexcusable custom.

The fact is that the term "lux" has been used in Germany since 1897, following its adoption by the Verband Deutscher Elektrotechniker and by the Deutscher Vereine von Gas und Wasserfachleuten. The action of these, the two largest German illuminating engineering societies, was the result of action taken at the Geneva International Electrical Congress of 1896, at which Professor Blondel proposed his excellent photometric system. This congress passed a resolution stating that for the purpose of facilitating the standardization of the units, and as a provisional measure, the bougie-décimale should be considered as equivalent to the hefner; and Blondel stated in a report to the 1896 Photometric Congress that the hefner differed inappreciably from the Violle unit.

It will be seen, therefore, that in the year 1897 the German illuminating engineering societies defined the lux as the meter-hefner, while another nation defined it as the meter-bougie, the two values being practically identical at that time.

It is worthy of note that the values of light from the two different candles have varied from time to time, somewhat as have stocks and bonds. In the year 1896 the hefner was equal to 1.02 bougies-décimale, a difference of 2 per cent. Subsequently Laport showed that the ratio of the hefner to the bougie-décimale was 1:0.885, a difference of 11.5 per cent; the International Photometric Commission in June, 1903, verified this value. From this moment there were two different "luxes"—the German, with the hefner as the unit of light, the other with the bougie-décimale as the light unit. The ratio of the two "luxes" to each other as established by the International Photometric Commission at Zurich in 1907 was 1 hefner = 0.895 bougie-décimale, but in the year 1909, when the international candle was created, 1 pentane candle = 1 American candle = 1 modern bougie-décimale = 1.11 hefner, thereby again changing the ratio of the two "luxes."

From the above it will be seen that since 1896 the bougie-décimale lux has had four different values, while the hefner lux has remained constant. It is noteworthy, too, that seldom has a term been so rapidly adopted as has the "lux" by the German engineers. An examination of the recent contributions to lighting literature will show that German authors have used the word "lux" almost exclusively. There have been few original communications dealing with the measurement of light in the French literature since 1896. In the numerous American and English writings I have not found the term "lux" as an expression for the light flux density, but instead thereof the term "candle-foot" or "foot-candle." It would seem, therefore, that the home of the word "lux" has been in the German literature. Now that the importance of a unit of light flux density is becoming appreciated, and the "lux," which has not been used outside of Germany, is looked upon as a suitable term for the unit, it is hardly proper to reproach German engineers for continuing to apply this term to a unit that has remained constant and not varied by 11 per cent.

In the year 1907 I published a proposal that there be established an international uniform unit of illumination; that each individual country be free to employ its own existing unit of illumination to be expressed in terms of the international unit by means of a measured or determined ratio of transformation. The word "lux" was suggested as an appropriate term for the international unit.

There is reproduced herewith a table, brought up to date by including the recently adopted international candle, which was originally published by me in 1907 for showing the ratios of the various units of illumination.

RATIOS OF ILLUMINATION UNITS—CONVERSION FACTORS.

Illumination units.	Meter-hefner	(German lux)	Foot-hefner (Foot-candle (International)	Meter-candle (International lux) (Meter-bougie)	Meter-carcel
Meter-hefner (German lux)		0.0929	0.0837	0.9009	0.093
Foot-hefner	10.76		0.909	9.71	1.001
Foot-candle (International)	11.95	1.11		10.76	1.034
Meter-candle (International lux) (Meter-bougie)	1.11	0.103	0.929		0.104
Meter-carcel	10.75	0.9986	0.966	9.61	

Augsburg, Germany. Berthold Monasch.

[Even if one assumes with our correspondent that all of the variations in the ratio of the hefner to the bougie-décimale

have been caused by changes in the latter, while the former remained impeccable, yet the fact remains that the *lux* was defined originally as the *meter-bougie*, and thus its value should have followed the changes in this unit rather than remained fixed by the meter-hefner, to which it happened once to be equal. Accordingly, the "lux" should now be considered solely as the equivalent of the international meter-candle differing by 11 per cent from the German meter-hefner.—Ed.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Rectifier.—A. Soulier.—A description of a rectifier for changing alternating current to direct current. In a former apparatus of this kind devised by the author only one-half of the alternating wave was utilized. In the present device he utilizes both half waves. The arrangement is shown in Fig. 1.

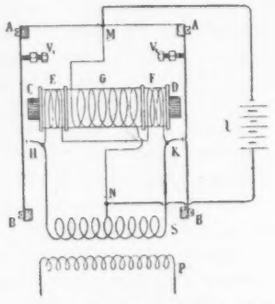


FIG. 1.—DIAGRAM OF RECTIFIER CIRCUITS.

Two vibrating telephone diagrams *AB* and *A'B'* suspended at their two ends have in their centers contact pieces which will make contact with the points *H* and *K* when the diaphragms vibrate. The soft-iron core *CD* has a coil *G* through which is passed a direct current, which may be taken from the rectified current obtained from the apparatus, as shown in the illustration. The two coils *E* and *F* at the two ends of the iron core are supplied with alternating current from the network. In the illustration *P* is the primary coil of a transformer connected with the alternating-current network. *S* is the secondary coil. All other connections are self-explanatory. From the points *M* and *N* a direct current can be taken off. This may be used to charge a storage battery, indicated by *U* in the diagram. The chief feature of the telephone diaphragms is that they will vibrate synchronously with any alternating current of usual frequency, say, between 25 cycles and 100 cycles per second. If the ratio of self-inductance to resistance of the circuits is properly chosen, it can be easily accomplished that the movement of the diaphragm is in time-phase with the alternating current, so that at the moment when the circuit is opened, the current is exactly zero. This can be easily obtained with the currents of from 10 amp to 30 amp at from 100 volts to 150 volts. Under these conditions there will be no sparks and the contacts will last a long while.—*L'Industrie Elec.*, Sept. 25.

Magnetic Properties of Iron-Manganese Alloys.—C. F. Burgess and J. Aston.—An account of an experimental investigation of the magnetic properties of iron-manganese alloys. Magnetization curves of such alloys, prepared with different heat treatment, are given. The deductions to be drawn from these tests have an important bearing upon certain problems in the manufacture of steel for electrical purposes, particularly steel castings. It is well known that there is a decided lack of uniformity in this material, and experience shows that numerous concerns have difficulty in making castings of this class, although for other purposes their product is of high grade. The results of the authors indicate a falling off in the magnetic quality of the alloys with an increase of manganese. For a percentage of 0.50 the permeability is only slightly less than that of the standard electrolytic sample. At 1 per cent Mn the quality has become appreciably less, and on further increase to 2 per cent the alloy is of comparatively low grade. It might be advisable not to use manganese in steel for electrical purposes at all. Of still greater importance, however, is the proper heat treatment.—*Electrochem. and Met. Industry*, November.

Movement of Energy in Generators.—F. Emde.—On the basis of Maxwell's electromagnetic theory, Poynting proposed 25 years ago a hypothesis on the movement of the energy in and around a wire carrying current. The present author applies the same theory to the movement of energy in generators. From the prime mover the energy is transmitted mechanically to the axle of the generator. The flow of energy in the generator is in a radial direction from the axle to the circumference. At the armature surface the energy is deflected from the radial direction and flows off in the form of electromagnetic energy through the air to the air space between the conductors on the transmission line. There the energy follows the laws of Poynting.—*Elek. und Masch.* (Vienna), Oct. 2.

Theory of Commutation.—J. Sumec.—The first part of a theoretical paper on the present status of the theory of commutation. The author discusses especially the two following problems: First, the self-induction and the strength of the commutating field, and, secondly, the question of the infinite current density at the moment when a brush leaves a segment.—*Elek. Zeit.*, Oct. 7.

Slip-Ring Motors.—F. Niethammer.—An article on devices for short-circuiting the slip-rings and removing the brushes when an induction motor has accelerated to full speed. The author describes and illustrates, first, the usual arrangement and then a second arrangement in which the slip-rings are placed, not side by side, but concentrically one in the other. The brushes slide laterally and the sliding surfaces are not cylinders, but planes perpendicular to the axle.—*Elek. und Masch.* (Vienna), Sept. 26.

Exciting Current.—E. Stadelmann.—An article discussing the principles of different methods of regulating the exciting current for separately excited single-phase or polyphase generators.—*Elek. Anz.*, Sept. 30.

Lamps and Lighting.

Increasing the Popularity of Electric Lighting.—E. Wikander.—As was noticed in the Digest, recently there has been in the columns of the *Elektrotechnische Zeitschrift* an extended discussion of ways and means for making electric lighting more popular, especially with small consumers. The present author, who started this discussion, is now summing up the results. He does not think that the present price of electrical energy is the main factor which prevents small consumers from using electric lighting. If this were true, the introduction of metallic-filament lamps should have brought far more connections than has been the case. He thinks that the main point must be to facilitate the wiring of houses and residences. Various central stations have already gone ahead in this direction, especially privately owned stations in contradistinction to municipal stations. The results seemed to show that such a policy has resulted in better financial returns. The author first mentions three chief methods. The first is that used by the Berlin Electricity Works to carry out the wiring free of charge, and then charge continually a high price for the energy. The second method is to carry out the wiring at the expense of the central station and to cover the cost by the stipulation that the consumer has to guarantee a certain minimum amount of payments during the first years, to cover both the cost of the

wiring installation and the cost of energy. This method has brought good results in Strassburg. The third method is to let the consumer pay for the installation and to supply him with energy for a certain time, for instance, for a year, either free of any charge or at greatly reduced prices. Other recommendations which have been made by various correspondents are to let the consumer pay for the cost of wiring on the instalment plan; the sale of suitable and inexpensive fittings by the central station; the reduction of the meter rent; sale of lamps, arc-lamp electrodes, etc., at cost to the central station; simplification of the wiring rules; putting before the public by advertisements and personal canvass from house to house the advantages and cost of electric lighting, etc. As to the question whether a flat rate is suitable it appears that just one-half of the correspondents were in favor of it and the other half against it. It appears that the chief reason advanced against a flat-rate charge is to be found in the fact that very often the flat rate has been placed at too low a figure. The remedy is evidently to make the yearly rate per kilowatt so high that with the long hours of lighting to be expected, the central station will earn at least as much per kw-hour as from the average of the consumers who pay a rate according to a meter. Fraud can be easily prevented by means of devices which limit the consumption. Such devices are much cheaper than meters. In fact, the use of such devices changes the whole character of the simple flat rate. The author recommends allowing the consumer to choose between the rate based on metering the energy and on the flat rate with limiting devices. He urges that more central stations should try such a system.—*Elek. Zeit.*, Oct. 7.

Flame-Arc Lamps.—A description of a new flame-arc lamp of the Siemens-Schuckert Company with "TB" electrodes for direct-current and alternating-current circuits. With the usual

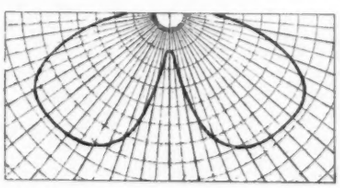


FIG. 2.—DISTRIBUTION CURVE.

flame-arc lamps quietness of the arc can be obtained only when the diameter of the electrodes is small. To get a sufficiently long life of the electrodes they must, therefore, be long and must be arranged side by side. Such lamps generally send most of the light vertically downward. With "TB" electrodes it is possible to use larger diameters and to get the same quietness of arc. Almost the whole cross-section of these electrodes is impregnated and only the thin surrounding cylinder which holds the impregnated electrode in shape is of pure carbon. Such thick electrodes can be made relatively short and arranged one above the other in the lamp. This gives the same favorable distribution of light as is obtained with arc lamps with pure-carbon electrodes. The distribution of candle-power is indicated in Fig. 2, which shows that the maximum of candle-power is at an angle of about 50 deg. from the vertical. For this reason the maximum of illumination of the

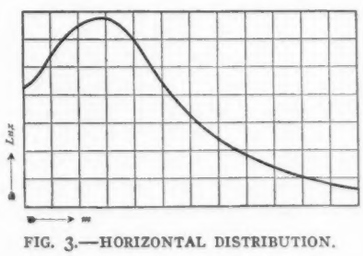


FIG. 3.—HORIZONTAL DISTRIBUTION.

ground is at some distance from the lamp. Fig. 3 shows the illumination of the ground by an alternating-current arc lamp with "TB" electrodes. The ordinates give the illumination in lux and the abscissas the distance of the point illuminated from the point below the lamp in meters. If arc lamps of this kind are arranged properly a very uniform illumination of the ground can be obtained. A special arrangement, which is not described, is used to prevent any deposition of salts from the evaporation of electrodes on the globe. It is claimed that after 16 hours of burning the globe is as clear as at the start. The light from these arc lamps is purely white. They are built either for 30 volts or 40 volts. The 30-volt lamps are used three in series at 110 volts. The 40-volt lamps are used two in series.—Supplement to *Elek. Zeit.*, Oct. 7.

Sale of Metallic-Filament Lamps by London Gas Company.—A letter and some notes on the sale of metallic-filament lamps (which are not the Osram lamp) by the Welsbach Incandescent Gas Lamp Company of London. No attempt is being made to cut the retail price of the lamps, which is the same as that of those with which the company is competing. The Welsbach company does not limit its business to its existing agents, but will be prepared to supply lamps to any firm of lamp dealers or wiring contractors on a trade basis. The offer to replace consumers' carbon lamps with metallic-filament lamps, and to accept in payment a sum equivalent to the reduction in the consumers' electric lighting bill, is also made to any lamp dealer or contractor. Consumers who write to the company to say that they are desirous of profiting by the offer advertised are asked to give the name of their lamp dealer, and, if the company is satisfied that the firm is a reputable one, the order is passed on to him and he carries out the work and makes the necessary arrangements for the collection of payment on the basis advertised. At any rate, up to the present no particular form of agreement with the consumer has been drawn up by the company, and the agent who supplies the lamps is left a free hand in this respect. Moreover, the company is prepared to indemnify the consumer and agent against patent proceedings. The Welsbach company's offer extends only to the replacing of carbon lamps by metallic-filament lamps, and does not include making any change in the consumer's wiring or any other alterations or additions to the consumer's installation.—Lond. *Elec. Eng'ing*, Oct. 7.

Counter-E.M.F. of an Arc.—C. D. Child.—A review of the literature on the subject of counter-e.m.f. of the electric arc shows that this expression has been used with several different meanings, and the most recent meaning is not the same as that given to the expression when applied to a cell or an electric motor. A review of the literature on the residual e.m.f. of the arc shows that the majority of experimenters have found such an e.m.f. whose value was somewhat less than 1 volt. This e.m.f. has been explained as being due to the difference in temperature of the electrodes. This was tested by cooling the anode by three different methods and the results were in harmony with such an explanation.—*Physical Review*, September.

Universal Arc Lamp.—A long letter by O. Arendt discussing Bermbach's recent paper on the Conta arc lamp, with special reference to the question whether patents of the Beck arc lamp have been infringed. Also reply of Bermbach.—*Elek. Zeit.*, Oct. 7.

Mercury Arc.—I. Ladoff.—An illustrated article on the evolution of the mercury-arc lamp from the earliest forms to the recent quartz lamp.—*La Lumière Elec.*, Oct. 2 and 9.

Generation, Transmission and Distribution.

Electricity in Building Operations.—The first part of an article in which a description is given of the application of the electric drive to the machinery employed by builders and contractors, typical installations of mortar mills, concrete mixers, etc., being illustrated. The opinions of a few building contractors as to the advantages to be obtained by the use of electric motors are then put forward, and finally the position of the electric supply authorities in various British towns is outlined, as indicated by the prices charged for electrical energy and the provisions made for hiring out electric motors.—Lond. *Electrician*, Oct. 1.

Motors in Mines.—Henke.—A paper read before the Electrical Society of Hanover on the use of electric motors in potassium salt mines for mining, hoisting, grinding the salt, etc., with special reference to the installation of the potassium salt works of Friedrichshall, A. G., Sehnde.—*Elek. Zeit.*, Oct. 7.

Traction.

Railless Omnibus.—Trial runs are being made with a trolley omnibus on an experimental road at Hendon, in England. The car has two 25-hp motors driving countershafts through bevel gears. A two-wire overhead construction is used, and contrary to practice in Continental Europe the frame of the car is electrically connected to the earthed negative trolley wire. A device to warn the driver if the car becomes connected with the positive wire is provided. As an alternative a three-wire line may be employed. The two sets of trolley wheels are mounted on the same head at the end of a double pole, and means are provided to counteract the side pressure when the car deviates from the center of the road.—Lond. *Elec. Eng'ing*, Sept. 30.

Installations, Systems and Appliances.

Control of Voltage.—W. Kallmann.—A paper read before the Berlin Electrical Society on the voltage control in central stations with the aid of variators—that is, iron resistors in a hydrogen atmosphere, such as are used in "ballast" in connection with the Nernst lamp. Fig. 4 shows the principle of the

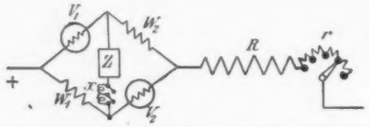


FIG. 4.—DIAGRAM OF CIRCUITS.

arrangement. V_1 and V_2 are two such variators, W_1 and W_2 are two resistors of constant resistance. Z is an amp-hour meter or other meter which may be connected in series with the resistor x to reduce the sensitiveness. For alternating current an induction meter is suitably used. R is a resistor of constant resistance, the value of which is chosen according to the voltage to be controlled. It is connected in series with the resistor of adjustable resistance r. The variators V_1 and V_2 may be enclosed in oil to increase their sensitiveness and the speed of the variations. The use of a meter Z instead of a voltmeter has distinct advantages as it enables one to get a much higher sensitiveness than with most voltmeters or relays, and, moreover, the rotating motion permits a very simple indication for optical devices. If account be taken of the fact that the voltage drop in the main current coil of ordinary electricity meters or in the main-current resistances of direct-

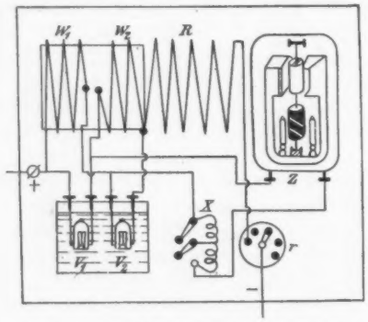


FIG. 5.—ARRANGEMENT OF CIRCUITS.

current amp-hour meters is hardly more than 1 volt at maximum load, it is evident that even a small voltage acting on the main-current coils will produce quite a strong rotation of the meter. The meters begin to run at 1 per cent of maximum load, so that an e.m.f. of 0.01 volt is sufficient to start the meter. A practical arrangement of this method is shown in Fig. 5. If the voltage rises or falls the meter will begin to rotate either in the one or the other direction.—*Elek. Zeit.*, Oct. 7.

Electricity in Agriculture.—Lewin.—An account of various electric installations made by the Allgem. Elek. Ges. for agricultural purposes in Germany. An account is given of three agricultural central stations. The Vangerom-Lottin station has a 300-hp water-power plant and an 180-hp steam plant as a reserve. This station supplies energy to 61 agricultural undertakings and five townships, together with 41,200 acres of arable land. The network of connecting wires is 137 km in length, supplying energy over an area of 270 sq. km. There are 102 consumers with 150 motors, equal to 1115 hp, and about 5000 incandescent lamps. During last year about 440,000 kw-hours were supplied at an average price of 3 cents for motors and 6.85 cents for lamps. The second station, Bartin-Beswitz, which commenced operations last year, started with a transmission line of 180 km, but 40 km have been added, and this station now supplies energy over 170,000 acres, of which 80,000 are plowed land. There are 180 motors and about 5000 incandescent lamps, representing a total of approximately 1300 kw. The price of energy for lamps is 6.25 cents; for motors there is a sliding scale of from 2.75 cents to 3.75 cents. Each member of the syndicate has to guarantee a minimum consumption of 5 kw-hours per year per acre of arable land. An estate of 2000 acres of plowed land must, accordingly, consume 10,000 kw-hours per year. The Birnbaum-Meseritz-Schwerin station has also begun operations, and already supplies energy to 10 estates and 14 villages. Transformers convert the high voltage to a lower pressure, such as is required for use on estates and in villages. The transformers are generally housed in small buildings; for field work, however, where the energy is required in various places, portable transformers are used. By means of a flexible connection the primary of the transformer can be joined to the overhead wires at any desired point, while the secondary is connected to the motor. Thus the agriculturalist is in a position to make use of the energy in any portion of his land. Electric locomotives are also used for agricultural purposes, and two plants in which electric energy is used for drainage purposes is noted. —Lond. *Elec. Review*, Oct. 1.

Calculating the Probable Financial Returns of a Central Station.—J. Mathieu.—The author thinks that on the basis of statistical data it is possible to get sufficiently accurate empirical constants by means of which to derive a formula which will indicate under which conditions a central station of given size will be financially successful. The author gives formulas and curves for the solution of this problem. One of the problems which can be solved in this way is the finding of the minimum number of kw-hours per year which a central station of a given kw-rating must produce in order to earn money. Different curves are derived according to the proportions of energy employed for lamps and for motors, respectively. Numerical examples are added.—*La Lumière Elec.*, Oct. 9.

Municipal Tax on Electricity.—F. Niethammer.—Some notes on and criticisms of the new tax on electricity which is to be levied by the city of Brünn, in Austria. It will be valid for the next three years, and after that the State itself seems to intend to levy a tax on electricity. The tax amounts of 0.4 cent for each cubic meter of gas consumed for lighting and to 2 cents for each kw-hour of electrical energy used in lighting. Since the price of the kw-hour in Brünn for lighting has always been high, namely, 14 cents per kw-hour, it will now be 16 cents.—*Elek. und Masch.* (Vienna), Oct. 10.

Wires, Wiring and Conduits.

Magnetic Blow-Outs for Circuit-Breakers.—A note on a recent British patent of T. Von Zweigberck (25,954, 1908; Sept. 30, 1909). In circuit-breakers for direct-current lines operating at e.m.f. of from 3000 volts to 4000 volts, the current density in the blow-out coils has, it is stated, to be of the nature of 20,000 amp to 28,000 amp per square inch in order to bring the size and cost of the coils within practical limits. Auxiliary contacts are sometimes used to charge the blow-out coil just before the switch is opened, but these are not always

satisfactory. According to the present invention, the current in the blow-out coil depends on the position of the arc to be blown out. In addition to the two main contacts a third is provided, and the blow-out coil is connected between this, and, say, the positive main. Normally, no current passes through the coil, but directly an arc is formed, it is transferred from the main positive contact to the auxiliary contact, so that the whole current passes through the blow-out coil. A description is given of special arrangement by which the blow-out coil is normally in series with a high resistance, the two being shunted across a low series resistance in the main circuit. When the arc jumps to the auxiliary contact, the two resistances are in series and are shunted across the coil, which then carries the main current.—Lond. *Elec. Eng'ing*, Oct. 7.

Electrophysics and Magnetism.

Source of Light Radiation.—T. P. Irving.—An account of an experimental investigation of the electrical character of the source of light radiation. The author has studied simultaneously the electrical and spectroscopic characters of the divided Bunsen flame, both in its simple state and when colored by metals or salts. One of the most important results of this investigation is the demonstration of the presence of principal series lines in sources whose electrical character presents qualitative differences. This fact is brought out most clearly in the case of lithium. The Li outer cone is electrically neutral and principal series lines are obtained from it; the Li flame above the inner cone is always positive and principal series lines are obtained from it also. Therefore, the principal series lines of Li arise from a positive or neutral source.—*Physical Review*, September.

Radiation.—S. J. Allen.—An account of an experimental investigation of the secondary radiation produced from solids, solutions and pure liquids by the beta rays of radium. Although in a great many cases the secondary radiation does seem to be a function of the atomic weight, yet there are many exceptions which are undoubtedly in some way closely associated with the way in which the atoms are combined with one another chemically. It is still too early to put forward any hypothesis to account for the experimental results.—*Physical Review*, September.

Photoelectric Effect.—J. Kunz.—A theoretical paper on the photoelectric effect of sodium-potassium alloy and its bearing on the theory of the structure of the ether.—*Physical Review*, September.

Discharges in Gases.—R. F. Earhart.—An account of the experimental investigation of the effect of temperature variations on the luminous discharge in gases at low pressures.—*Physical Review*, September.

Electrochemistry and Batteries.

Electric Zinc Smelting.—E. Fleurville.—An illustrated article in which the author first considers the possibility of electric zinc furnaces compared with the present retort furnaces. He then gives a review of experiments made with the Côte-Pierron process, which is now in use on a commercial scale in southern France. In order to facilitate the condensation of the zinc vapor use is not made of carbon as a reducing agent, but iron, and by the direct reaction between zinc blende and iron in the electric furnace they obtain iron sulphide and zinc vapor. The latter is not diluted with inert gases like carbon monoxide, so that the condensation will be more easily accomplished. For the present they have, however, only produced zinc white, and for this purpose they use the reaction between zinc blende and lime and carbon. The process seems to be a commercial success.—*Electrochem. and Met. Industry*, November.

Electric Furnace Efficiency.—C. Hering.—An article on the electrode efficiency of furnaces, supplementing the author's former article on furnace electrode losses. For any given electrode material there exists a minimum drop in voltage between the hot and cold ends of the electrode. It depends on the temperature difference between the two ends, and on the ratio of the electric and thermic conductivities of the material. For graphite it is 0.0231 volt per degree Centigrade.—*Electrochem. and Met. Industry*, November.

Pinch Effect.—J. Harden.—An account of various observations of the "pinch effect" in electric furnaces of the induction type, with additional notes on the peculiar movements of the charge in an induction furnace.—*Electrochem. and Met. Industry*, November.

Tungsten Valve Electrode.—L. H. Walter.—The metal tungsten, like aluminum and tantalum, behaves as a valve electrode in a large number of electrolytes, those which have been tried being for the most part of high conductivity and less adapted to the securing merely of high critical voltages. The critical voltages in the strong acids are, as a rule, higher with tungsten than with aluminum, but not so high as with tantalum. The maximum pressure obtainable being 90 volts, it was found that this voltage could be withstood by the tungsten anode in sulphuric acid of 1:15 concentration (15), in potassium iodide (0.2), acetic acid (0.1), potassium bichromate (1.8), sodium potassium tartrate (0.1), and borax (1.0) solutions, none very dilute. The sensitiveness of the tungsten valve to heating is not at all pronounced, while the valve seems to be very sensitive to the cutting off of the current. For practical uses the high concentration of the acid must be taken into account.—Lond. *Electrician*, Oct. 1.

Units, Measurements and Instruments.

Magnetic Measurements.—V. Bjerknes.—A highly theoretical paper on the absolute measurement of electromagnetic quantities.—*Physical Review*, September.

Telegraphy, Telephony and Signals.

Telephone Transmitter.—Successful experiments made with a new telephone transmitter of C. E. Egner and J. G. Hölmstrom over a 4.5-mm line between Stockholm and Paris, about 2500 miles in length, have been noticed before in the Digest. The construction of this transmitter is the subject of a recent British patent (12,918, 1909). The principle upon which the instrument is based is that the diaphragm is so clamped that there can be no doubt that the point of the greatest vibration is exactly at the center, and the front disk of the microphone (which in this instrument is not formed by the diaphragm itself) is so fixed that its entire surface moves with this maximum amplitude. This arrangement is indicated in Fig. 6.

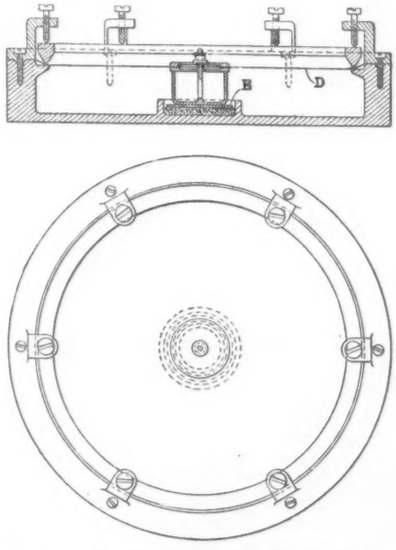


FIG. 6.—TELEPHONE TRANSMITTER.

The method of clamping the diaphragm *D* with an additional clamping ring is shown, as is also the attachment of the front disk *E* of the microphone, which, it is seen, is devised in such a manner that the movement of the ends of the disk is the same as that of the center. As an alternative form, there is described a multiple transmitter in which use is made of a number of microphone cells fixed at several points around a

disk F, as shown in Fig. 7—in which, however, one only of the microphone cells is shown so as not to confuse the sketch. There will thus be absolute synchronism between all the cells. The thin cylinder connecting the disk F to the diaphragm is of steel, and is perforated to save weight and also to assist cooling. The cups containing the carbon granules are supported in such a way that by rotating the ring G the height of them all can be adjusted simultaneously, while the screw H affords a means of adjusting each cell separately. In a previous patent (6587 of 1908, the only other patent taken out by these inventors during the past few years), a description is given of a microphone in which is hermetically sealed the chamber containing the granules and holding hydrogen or a hydrocarbon gas instead of air.—Lond. *Elec. Eng'ing*, Oct. 7.

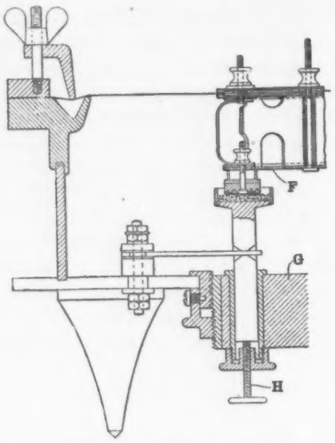


FIG. 7.—TELEPHONE TRANSMITTER.

Multiplex Telephony.—A Maior.—The author purposes a system of multiplex telephony in which the microphone currents

FIG. 8.—PRINCIPLE OF MULTIPLEX TELEPHONY.

are superposed on an alternating current and use is made of resonance phenomena. The principle is shown in Fig. 8, where the two stations are shown at the left and right. E is a high-frequency alternator. In the left-hand station M_1 and M_1' are two microphones and T_1 and T_1' two telephones. Z_1 and Z_1' electric rectifying valves; for instance, electrolytic aluminum rectifiers. They are so arranged that one rectifier permits one-half of the alternating current to pass while the other rectifier permits the other half to pass. In the right-hand station the electrolytic valves are so arranged that Z_2 permits the passage of only the half of the wave which comes from Z_1, while Z_2' permits the passage of only the half of the wave coming from Z_1'. The microphone currents superposed in the circuit a upon the high-frequency current can be heard in the circuit A by the telephone T_2 and the microphone currents superposed in the circuit b can be heard in B by the telephone T_2'. On the basis of this principle it is possible to transmit four conversations simultaneously with the aid of two alternating currents. The difference of the frequencies of the two alternating currents

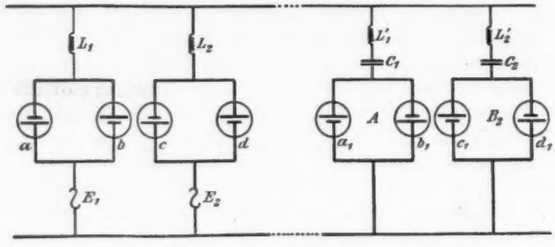


FIG. 9.—DIAGRAM OF CONNECTIONS.

must be found experimentally. The connections are shown in Fig. 9. E_1 and E_2 are two alternators with different frequencies. L_1, L_2, L_1' and L_2' are inductance coils, while C_1 and C_2 are capacities, so that the system A is brought into resonance with E_1 and system B in resonance with E_2. The electrolytic valves are so arranged that the microphone currents from a are passing only through a_1, from b only through b_1, from c only to c_1, and from d only to d_1. The microphones and the telephones are not shown in this diagram. The same principle may be used for multiplex telephony.—*Elek. Zeit.*, Sept. 23.

Wireless Telegraphy.—J. Bethenod.—A mathematical paper on the calculation of the damping constant in an antenna with indirect shunt excitation.—*La Lumière Elec.*, Oct. 2.

Miscellaneous.

Engineering Profession.—G. A. Thomas.—A paper read before the (British) Society of Engineers. The author deals at length with a number of ways in which the present position of the engineer, both internally and relative to other professions, might be improved. Overcrowding, misuse of the word "engineer," and multiplication of societies and other evils requiring mitigation are gone into, and schemes for education and registration suggested. The disabilities of consulting engineers are also considered.—Lond. *Electrician*, Oct. 8.

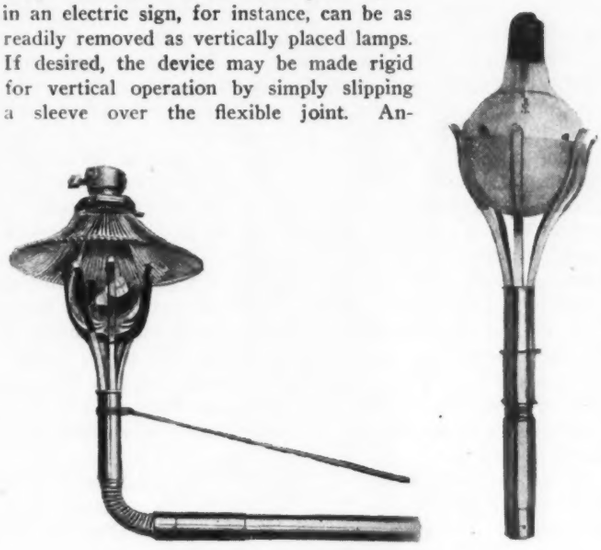
NEW APPARATUS AND APPLIANCES

National Electric Lamp Association at New York Electrical Show.

The exhibit of the engineering department of the National Electric Lamp Association at the New York Electrical Show occupied the same position that it did in previous years, at the right of the main entrance. All types of the regular multiple tungsten lamps in prismatic reflectors, hanging pendant from arches which conformed to the general style used in the show, surrounded the booth. Upon special exhibition racks were exhibited all of the latest improvements in tungsten high-voltage sign and multiple 110-volt types, as well as the tantalum series-burning lamp for street-railway service and the high-voltage tantalum. This portion of the exhibit showed the most recent developments in the lamp industry. Street series-tungsten lamps held a prominent position, being equipped with regular street-series prismatic reflectors and suspended from brackets on the corner posts. The tungsten sign lamp for low-voltage circuits, which is coming into very general use, was given special attention. The exhibition of the original carbon-filament incandescent lamp made by Goebel long before the cellulose carbon-filament lamp was invented created a great deal of interest. In the center of the booth was exhibited a large glass case which contained a complete line of tungsten, tantalum and Gem lamps, both regular and miniature styles, hanging pendant from brass fixtures. The entire furnishings of the booth were in conformity to a special finish of oak, which was uniform for the cases, racks, tables, chairs, etc. The exhibition of the Engineering Department was in charge of Mr. P. F. Bauder, assisted by Messrs. P. S. Dodd, C. O. Brandall and N. H. Boynten.

Adaptable Lamp-Changer.

A simple, but ingenious, lamp-changer intended to facilitate the placing and removing of incandescent lamps in places that would be otherwise inaccessible except by the use of a ladder is illustrated herewith. The device is adjustable to any type or size of lamp, and is provided with a flexible spiral joint so that lamps installed in a horizontal position, as in an electric sign, for instance, can be as readily removed as vertically placed lamps. If desired, the device may be made rigid for vertical operation by simply slipping a sleeve over the flexible joint. An-



FIGS. 1 AND 2.—LAMP-CHANGER.

other sleeve is provided by which the opening on the jaws adapted to receive the lamp may be regulated. Thus, the device can be used for a large meridian lamp, as shown in one of the illustrations, or it can be made small enough to remove the base of an ordinary incandescent lamp in case the bulb should be broken off. The tool is compact and well made, and weighs only 4 oz. without the pole or handle. Poles are furnished separately, and can be either of nickel, steel, aluminum or wood. The jaws of this lamp-changer are protected by rubber so that no damage to the lamp will result in screwing it into the socket or taking it out. The device is made by the Illinois Appliance Company, 646 First National Bank Building, Chicago.

Pocket Meters.

Those engaged in electrical pursuits have become so accustomed to the large power installations of the present time that they are apt to lose sight of the fact that an immense number of units of energy in the aggregate are being used in the

POCKET METER.

shape of dry cells and small storage batteries, and that the daily production of batteries in this country, measured by their kw-hour capacity would, if known, be astonishing.

The widespread use of batteries has led to a demand for small pocket meters with which to test them, and the Hoyt Electrical Instrument Works, early recognizing the importance of this field, have devoted a great deal of attention to it. Their latest addition to their line of small meters consists of ammeters and voltmeters approximately the size of a No. 16 watch. A novel feature of these instruments is a silver-plated metal scale which combines accuracy, durability and tastiness in design. Realizing that the first requisite is careful standardization, the makers claim to have designed every part so carefully that exhaustive tests have failed to show any material error in any part of the scale.

These meters are of the permanent-magnet type, and in designing them the purpose of their use has been constantly kept in mind. The relation of the moving system to the poles of the permanent magnet is such as to insure a practically dead-beat movement, with extreme sensitiveness to current changes. Every detail has been carefully looked after, even to the construction of the case, which is substantially made in one piece to insure rigidity and mechanical accuracy.

A novel design of lettering has been adopted for the dial, and it is the purpose of the makers to carry out the same idea in all instruments of this type in order to distinguish them readily from other meters of somewhat similar general appearance.

Screwless Monkey-Wrench.

The Wright Wrench Manufacturing Company, Canton, Ohio, has brought out a monkey wrench which differs radically from the familiar type on the market. It is made without a screw, and is adjusted to fit the nut by means of a slight pressure upon the jaw with the thumb of the hand holding the wrench. The

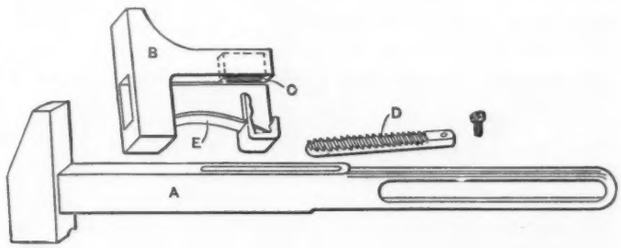


FIG. 1.—DETAIL PARTS OF SCREWLESS MONKEY-WRENCH.

device is made of drop-forged steel, carbonized, mottled and hardened, and consists of the following parts: The bar, which forms the handle and head; the jaw; the pawl set into the jaw; the rack, which when the wrench is put together is set into the bar and held in place by a set screw, and the spring. When the wrench is put together the jaw slides up and down on the bar, after being released by a slight pressure of the thumb. When the jaw is adjusted to fit the nut the pressure is taken off the spring, and immediately the pawl engages the rack holding the jaw firmly in position. The pawl and the rack have

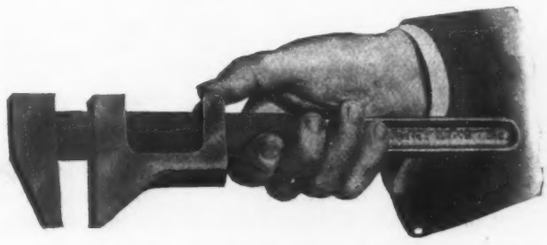


FIG. 2.—SCREWLESS MONKEY-WRENCH.

a set of ratchet-like teeth, which fit into each other and prevent the jaw from having any play after it is once set. The jaw is instantly released from the nut, however, by a slight pressure upon the spring. The standard wrenches are made in 6 in., 8 in., 10 in., 12 in., 15 in. and 18 in. sizes.

Meeting of Technical Publicity Association.

The first of the Technical Publicity Association's monthly meetings for 1909-10 was held Thursday evening, Oct. 14, in its headquarters, 14 Gramercy Park, New York. The president of the association, Mr. Charles S. Redfield, advertising manager of the Yale & Towne Manufacturing Company, was toastmaster. The only extended address was that of Mr. George French, editor of *Advertising and Selling*.

Mr. Howard M. Post, advertising manager of the Western Electric Company, told of plans for a systematic, analytical study of effectually tracing results from trade-paper advertising. The keying method, he said, has proved inadequate, and there should be some way of determining the effect of such advertising. At the conclusion of a discussion of this subject Mr. Post was made chairman of a committee to outline this study work for the association.

The remarks of Mr. French were an interesting presentation of the psychological and artistic aspect of advertising. His hearers were taken into the field of optics, and shown the effect advertisements have upon the eye of the reader.

Mr. French took as his text the postulate of Hugh Chalmers in a recent address at Louisville, namely, that every sale by anyone anywhere is made in a man's mind—the mind of the one to become the purchaser. "Advertising is profitable," he said, "only when we consider this one thing. The individual advertisers are the men who create, who place, who look at this. If I am to do anything, if I am to be effective, I have got to get the mind of the man to whom I am to sell goods. We all realize this, and all work toward it. If we want to arrive at any point, even if that point be the North Pole, we want to locate that place first—to fix it on the map. I will assume that in order to sell goods there must be a salesmanship message in the mind of the customer. The question is how to place that message; what kind of place is the mind; how does it comport itself; what that message is to be, and how is it to be sent."

This led to the statement of the subject, psychology. He made his chief point in the phenomenon of suggestion. "It is well to assume," continued Mr. French, "without any discussion that every human mind is favorably inclined to receive a suggestion. This is a psychological fact, established and indisputable. There are many fallacious ideas in circulation about suggestion. There is nothing occult about it. It is not even mental, but purely a physical quality of the mind. It is guided by definite, well-known, or rather, well-ascertained laws. Memories and forgotten knowledge are in the mind, and help to make its decision." The illustration Mr. French gave was that of a fork in a road. "A man must decide," he said, "which way to turn, whether to the right or left. Once he has made his decision to go to the right, all thoughts and ideas having any connection with the left road are banished from his consciousness." Mr. French added that it adds greatly to one's power and his clearness of expression and lucidity to look up psychology and the matter of suggestion. Reference was made in passing to Prof. Hugo Münsterberg's "Psychotherapy."

Mr. French then came to the second part of his subject, which he declared to be more or less allied with psychology. "The principles and fundamentals of art are a great help also to advertisers," he said. "This is largely mechanical, largely psychological. In advertising it is of the first importance. You must think of your advertisement as a picture. The eye has to have something to attract it, or a person can't be impressed. The impression is dulled unless there is a distinctive something to attract the eye, like a picture. Certain elements or qualities go to make an advertisement attractive. These are the same that lie behind every piece of art; that is, true art. Some of these are form, proportion, balance, harmony, tone, symmetry, perspective, color. They are easy to get if in planning you have in mind their usefulness. The most common form in advertising is the oblong rectangle. This is a rule of proportion. It can't be varied without bad results. Three to five, broadly, are the proportions. This is about the shape of a magazine text page. It is also the proportions of a properly constructed cross. Radiating from the point of intersection of the cross one may work out symmetry, harmony and tone. A harmonious tone is almost impossible with the use of half-tone illustrations. Personally, I am very glad to see the renaissance of the line engraving, or the pen-and-ink sketch, in the work of advertising. It doesn't 'hog' all the attention given to the advertisement.

"This is a profitable line of study. Advertising may be made especially attractive, and one may trace the cause back to these principles. Some advertisers, I do not recall now just which ones, use lower-case type in the display line to produce a harmonious effect. These principles of art have never been gathered together anywhere especially for advertisers. We have to read through a good many books, and perhaps only a few pages in each have direct bearing.

"One other line of study is well worth reading up a little, and that is optics. The power of the eye is extremely limited. It seeks to reject the printed matter we seek to impress upon it. It acts in a seemingly erratic manner in reading. It doesn't travel steadily, but in jerks and jumps. These are known as fixation points. The eye wants to stop; it goes on haltingly, painfully. The normal reading line is not over 3½ in. wide. This the eye can take in with five, six or seven fixations. It should be divided up so that the eye can read it easily. Catchlines should be of such a nature that the eye can pick them up without conscious impulse—without any effort of the will. There should be no obstacles. This is of the utmost importance to the advertiser."

In response to a query as to the size of the type, Mr. French said that "Type below 9-point is apt to be less agreeable than 9, 10 or 11. We must also consider the design. Only two or three designs of type face endure. All publishers have noticed how many series of type have dropped out of use. Almost all that have lasted are of the pure Roman style, because it is more agreeable to the eye. Caslon type, now more than a century old, is just as popular to-day as when first put forth."

Mr. French re-stated his thesis in the words that "It is from science and pseudo-science, from art and physiological-psychological questions, such as optics, the groundwork of advertising, that we can gather a great fund of strength and knowledge. Not only that, but it is a delightful field to grub around and study in."

After disposing of business matters the association adjourned to meet again in the same place on Nov. 11.

Semi-Enclosed Arc Lamp.

The Stillwell-Van Demark Company, of New York, has placed on the market, under the trade name "Stilvan," a type of semi-enclosed arc lamp said to possess a number of desirable features in construction. Rigidity is imparted to the structure by two parallel rods which run the length of the lamp and to which the various parts are secured. The upper electrode holder guide is of the parallel rod construction, insuring free movement of the holder. The circuit connection to the positive electrode is made through a flexible wire and screw contact on the holder. In this lamp small diameter carbons held in coaxial relation to each other are used and burned at a high-current density. This causes the carbon points to heat to a white-hot incandescent stage and after the lamp is burning for a short time the gases collecting in the globe, due to the combustion of the carbons, are claimed to become highly luminous. By using this principle the manufacturer says a large volume of steady, well-distributed, white light is obtained. The specific consumption is stated to be approximately 1 watt per mean lower hemispherical candle-power in one of the smaller types of lamp. The intense heat from the arc with ordinary construction would destroy the working mechanism through failure of the insulation of the electromagnet. The manufacturer employs an electromagnet, wound under a patented process, which is stated to be indestructible under operating conditions. Uniform burning hours of carbons are obtained by a method of globe protection and support which gives a tight-fitting globe. The latter is held in position by a wire ball which supports it

from the bottom. With this method small variations in globe dimensions do not affect the holding of the globe in its proper position. This support and the economizer ring which fits over the open end of the globe reduce the possibility of shipping and globe breakage to a minimum. The parts are all accessible and the entire construction is said to be the acme of simplicity. The lamps are built to operate in multiple on both direct-current

SEMI-ENCLOSED ARC LAMP.

and alternating-current circuits. To meet the various conditions required in practice, a number of different types of lamp having various designs and dimensions, power consumption, carbon burning hours and giving different volumes of light have been developed. The company's standard 4-amp direct-current lamp is made in two types, one burning approximately 30 hours and the other 70 hours. Both are adjusted for 4 amp and 76 volts at the arc when operated in multiple on 118-volt circuits and may be adjusted for 110-volt to 120-volt circuits as well. The alternating-current lamps are adjusted for a current consumption of 6 amp with a difference of potential of 72 volts across the arc on 110-volt circuits of frequencies of from 60 cycles to 133 cycles. The lamps may be adjusted for circuits having potentials of from 104 volts to 120 volts. Under ordinary conditions the carbon life in the alternating-current lamp is 30 hours. The lamps are adapted for interior lighting of stores, silk mills, etc., where a daylight quality of light is required.

Softening Boiler Make-Up Water.

The apparatus shown in the accompanying illustration, made by the Harrison Safety Boiler Works, Philadelphia, has been especially designed for use in connection with exhaust-steam heating and drying plants where the make-up water requires softening. It is so arranged that the reagent is fed continuously in proportion to the inflow of the make-up water, and suitable provision is made for the removal of the resulting precipitate from the water by sedimentation and filtration. A special feature is a by-pass which comes into play automatically in case the filter should be neglected and allowed to clog, thus insuring a supply of hot softened water to the boiler-feed pumps at all times.

The apparatus shown also has attached to it a new surplus-exhaust separator which the above concern has recently devised for use on heaters and receivers installed in connection with exhaust-steam heating and drying systems. This separator differs from the Cochrane oil separator heretofore used on heaters made by this concern in being extra large and in having an outlet at the top for passing the purified exhaust steam to the heating system directly without need of an independent oil separator. Convenient valves are also provided for cutting off connection between the separator and the heater, and between the trap which drains the separator and the heater, so that the heater body can be cut out of circuit and opened for cleaning and inspection while the heating system continues in operation. This does away with the independent oil separator and trap, and with the valves, tees and elbows required for its installation, cutting down the first cost of the plant and the space required, while increasing convenience of operation.

The makers guarantee for this apparatus that where it is operated in accordance with their instructions, hard scale will not form in the boilers, which can be washed out by means of water from a hose, and that the boilers will be entirely protected from corrosion. They also guarantee that water heated by exhaust steam that has been passed through the oil separator attached to the apparatus, or water condensed from the steam itself, will be entirely suitable for boiler feeding and other purposes.

In the apparatus shown, the return and treated water are mingled together in the sedimentation chamber and the whole volume is passed through the filter; but where the percentage of returns is large it may be advisable to give over the entire sedimentation and filtering capacity to the make-up water alone and to pass the pure condensed returns, after reheating, directly to the pump-supply chamber. This gives better results than if the two water supplies are mingled before treatment.

This apparatus is equally applicable in the case of surface condensing steam-power plants where the condensed water is utilized as boiler feed, in which case there is the large volume of condensation to be heated and a comparatively small vol-

APPARATUS FOR SOFTENING BOILER MAKE-UP WATER.

ume of supplementary make-up water to be heated and softened. The apparatus can then be so arranged that the exhaust steam will first come in contact with the make-up water, insuring full temperature for the chemical reaction, before heating the vacuum-pump discharge. This apparatus thus saves a large part of the cost of separate feed-water heater and water-purifying systems, and makes it possible to purify

the small amount of raw water at a merely nominal cost. The driving off of air and gases from the feed water reduces to a certain extent the amount of gases to be dealt with by the vacuum pump, while the elimination of scale-forming matter from the water should obviate the gathering of scale upon and erosion of turbine blades.

Intercommunicating Telephone System Used in Connection with Dispatching Trains.

At the Erie Railroad terminal station, Jersey City, N. J., an intercommunicating telephone system is used in connection with the dispatching of the suburban trains and for directing commuters to their trains. It is also the connecting link between these suburban trains and the Hudson & Manhattan Railroad Company's tunnel trains, running from the station to New York City.

The tunnel trains do not enter the Erie depot, but stop at a point 900 ft. west of the ends of the train sheds opposite to the station. At the ends of the sheds nearest the tunnel is a well-lighted and ventilated underground concourse, which is connected to the tunnel train platform by a subway. Five stairways, one for each pair of suburban tracks, lead from the concourse floor to the tracks at ground level. The stairways are seen at the left of the accompanying photograph, Fig. 1.

The dispatching tower at the Erie station, which is located at the end of the train sheds and overlooking them, is shown in the partial interior view of Fig. 2. At the right, the intercommunicating desk set for the gate-control system is mounted on an equipoise arm. The ringer and key box connected with this set are to be seen behind one of the levers on the desk. On the gate-control system are the tower set and five wall-type intercommunicating sets, shown in Fig. 1—one at each stairway leading from the concourse floor to the train sheds. All the apparatus installed is according to the latest designs of the Western Electric Company. The sets have an ultimate capacity of 11 connections. The conductors connecting each set with all of the others are carried throughout in lead-covered cables, and are insulated with double-cotton and silk, differently colored for identification.

The operation of this part of the system is as follows: Suppose the commuters live in Bloomfield and Montclair. They

FIG. 1.—VIEW OF STAIRWAY FROM CONCOURSE.

enter the concourse from the Hudson tunnels, by way of the subway, but the closed stairway gates prevent their going to the train sheds. The dispatcher presses the button on his key box marked 7 and 8. This act automatically connects his set with the one at the gate to tracks 7 and 8 and rings that bell. When the guard answers he is told to put up signs that the Bloomfield, Montclair, etc., train will leave track 8.

When the train is ready the dispatcher rings a gong over the gate. The guard then presses the properly numbered one of the two buttons under his telephone and opens the gate. Should the button pressed show the dispatcher that the guard is opening the wrong gate, or if there is any other misunderstanding, the guard can be easily reached by one of the intercommunicating telephones. When to close the gate and other instructions are given by telephone.

The gongs referred to are controlled by means of the long

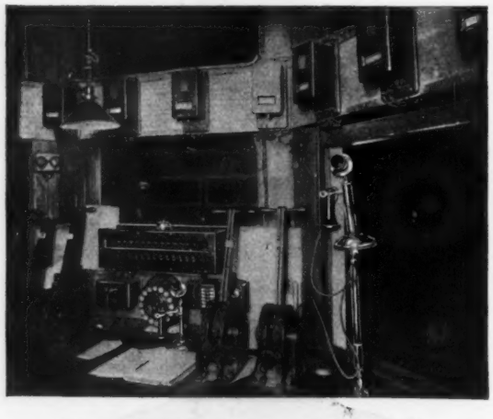


FIG. 2.—INTERIOR OF DISPATCHING TOWER.

box in front of the tower window (Fig. 2). The buttons at the bottom ring the gongs for the 10 suburban and four other tracks. When a guard presses the bell button under his telephone, the bell on top of the control box rings and a corresponding numbered drop appears in the row at the top of the box. The control is of special design and was built by the Western Electric Company.

In the dispatcher's office is a second and similar intercommunicating set. On this system are sets for the trainmaster, stationmaster, terminal tower, engine yard and passenger yard. These have proved sufficient for keeping the dispatcher in touch with train make-ups and special work. In the center of the view of the tower is a desk set connected to a three-plug magneto party line system. This old system is kept in place for emergency uses.

The desk equipment of the chief attendant in the concourse

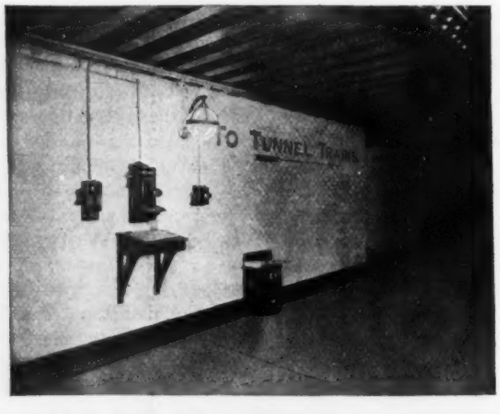


FIG. 3.—TELEPHONE EQUIPMENT IN CONCOURSE.

is shown in Fig. 3. The set to the left is on the gate-control system and is for tracks 1 and 2. The wall-type magneto set, in the center, is connected to a similar set on the tunnel train platforms and is used to announce arrivals of the tunnel trains. The use of this set enables the dispatcher to know the schedule of the tunnel trains and regulate his make-up accordingly. The third set, farthest to the right, is on another system maintained by the Hudson tunnels.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The continued cool weather has added to the already buoyant condition of trade. In practically every line of business conditions are entirely satisfactory. Hardware, groceries, lumber and building materials are especially active. Wholesalers and jobbers are receiving many reorders to fill out stocks which have been depleted by the active retail trade. Merchants all over the country are already preparing for the holiday trade, and the prospects are that this trade will be the best that has ever been known. There is still considerable evidence of conservatism in buying, which is due almost entirely to the high range of prices for all commodities which now prevails. This is especially noticeable in the cotton goods trade, where prices have been advanced and where manufacturers are holding rigidly to the high schedule. In spite of the abolition of the duty on hide, the shoe and leather business is being transacted on a higher scale than ever before. Prices have not been reduced, and on many classes of goods have been advanced. In quite a number of industrial localities there is complaint over the scarcity of skilled labor. In the iron and steel mills this is especially true. There is at this time some talk of car shortage, but thus far this has not interfered in any way with the free movement of the crops. Both corn and cotton have been sent to market with remarkable freedom, resulting, of course, in liberal additions to the spending money of the producers. This is one of the reasons that retail trade has shown such commendable growth. It is also due to this fact that collections have visibly improved. Business failures for the week which ended Oct. 21 were 244 as against 220 the previous week; 231 in the same week of 1908; 220 in 1907; 184 in 1906, and 178 in 1905.

THE COPPER MARKET.

There has been little doing in the copper market during the past week and prices have been lower. The stringency of the money market and the advance of rates abroad caused considerable liquidation and the first effect was a drop of 17s 6d. in London. The carrying charges for standard copper abroad have been advanced, causing anxiety among the speculators and practically putting an end to new commitments. Such conditions might have resulted in demoralization in this market had it been less firmly in the grasp of the strong interests which have so long been in control. As it is, while the market has been weaker and lifeless there has been no pressure to sell and price concessions have been fractional. Domestic consumers have taken little interest and purchases have been moderate. The statistical position remains unchanged practically. Production goes on at record quantities, domestic and foreign are only fair and there is evidence that stocks are being increased from 30,000,000 to 40,000,000 lb. every month. During the week there was a long conference of the leading copper men of the country at the offices of the Amalgamated company which revived rumors of a giant merger and also of a curtailment agreement. All of these rumors met prompt denial. Imports continue to be heavy and exports for the month, including Oct. 25, have amounted to 18,235 tons. The daily call on the Metal Exchange at 12:30 o'clock Oct. 25, quoted standard copper as follows:

	Bid.	Asked.	Settling price
Spot	12.00	12.25	.....
October	12.00	12.25	12.12½
November	12.00	12.25	12.25½
December	12.00	12.25	12.12½

The London prices Oct. 25 were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	56 12 6	56 8 9
Standard copper, futures	57 15 0	57 11 3
Market	Easy	Easy
Sales of spot	1,500 tons	
Sales of futures	1,800 tons	

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.00	12.12½
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

KELLOGG-DEAN ELECTRIC COMPANY.—The arrangements for the combination of the Kellogg Switchboard & Supply Company, of Chicago, and the Dean Electric Company, of Elyria, Ohio, previously announced in these columns, have progressed so far that it may be stated that a new company will be formed to absorb the two old ones. This company will be known as the Kellogg-Dean Electric Company, and its headquarters will be in Chicago. Both the factories at Chicago and at Elyria will be retained. The capital stock will be $7,000,000, of which $3,500,000 will be 7 per cent stock, preferred both as to dividends and assets, and $3,500,000 will be in common stock. The new company has not been organized, but it will have a board of directors containing some of the most prominent men in the independent telephone industry in the United States. The arrangements are being made under the legal advice of Mr. Charles H. Aldrich, of Chicago, former solicitor-general, who has taken a leading part in telephone affairs for a number of years.

LAMP MEN'S CLUB.—The National Electric Lamp Association last week opened a clubhouse at 1910 East Fifty-fifth Street, Cleveland, to be known as the National Club. Only members of the association can belong to the club. It is for the younger men, who coming from college, join the engineering staff of the association, that they can live at the club, a dining-room, gymnasium and bed-rooms being provided for them. The clubhouse is made over from two former dwelling houses, and a third house adjoining them, at present occupied by part of the engineering staff, will shortly be added to the present club accommodations. Judging from the enthusiasm shown at the opening and from the number of applications for membership, the National Club will prove a very popular institution.

OHIO ELECTRIC CAR COMPANY.—The organization of the Ohio Electric Car Company at Toledo has practically been perfected. This concern is a reorganization of the old Pope Company and will manufacture electric vehicles. The capital stock was immediately subscribed by Toledo capitalists, a large number taking part as the limit of the company was $5,000 to any individual. The interest in the new company was largely stimulated by a trial run of a car from Toledo to Cleveland, 184½ miles, on one charge of the battery. The office and works of the company are located at the Milburn Wagon Company's plant, which, it is said, is admirably adapted for this purpose. The company is preparing to make a large output of cars for 1910.

BUSINESS IN THE FAR WEST.—F. H. Gale, advertising manager of the General Electric Company, has just returned from an extended trip through the West. He attended the meetings of the Northwest Electric Light & Power Association at Seattle, the Colorado State Electric Light & Power Association and the American Street & Interurban Railway Association at Denver. He also attended quite a number of Institute meetings during his trip. Mr. Gale said that he found business everywhere in the West in splendid condition and on the Pacific Coast especially was the progress noteworthy. In that section there was marked growth in every branch of the electrical industry.

DUTY ON REFLECTORS REDUCED.—The Board of United States General Appraisers has decided that reflectors for electric lights are dutiable at 45 per cent, either as manufactures of glass or of metal. Until recently collectors had been assessing this class of goods at 60 per cent, on the theory that the glass was silvered for the purpose of ornamentation. The Appraisers' Court holds that the silvering process is for utility and that the reflectors should not pay the rate demanded on ornamental glass. George Borgfelt & Company were the importers which raised the issue.

NEW ELECTROLYTIC METAL REFINING PLANT.—The United States Metals Refining Company, with extensive works for refining copper by electrolytic methods located at Carteret, N. J., has recently purchased 12 acres adjoining its plant upon which will be erected a large establishment for refining lead.

MICHIGAN CENTRAL TRAIN DISPATCHING.—The Michigan Central Railway has just completed a telephone train-dispatching circuit between Niles, Mich., and Kensington, Ill., a distance of 76 miles. There are 18 regular train-order stations and two emergency stations. The emergency stations are for the use of train crews and are so arranged that a crew may at any time stop at these sidings and call up the dispatcher to obtain assistance if necessary, or get instructions to go ahead if the track is clear. This installation is on the main line of the Michigan Central Railway, between Chicago and Detroit, and is the fourth circuit of this kind installed by this road. When the circuit now being installed between Jackson, Mich., and Niles, Mich., is completed, all trains run between Chicago and Detroit, Detroit and Toledo, and Detroit and Saginaw on the Michigan Central Railway will be dispatched and receive all running orders by telephone. This equipment of about 500 miles, one-fourth of the entire Michigan Central mileage, was furnished by the Western Electric Company. It is reported that extensions will be made as expeditiously as possible until every train on this road receives its orders by telephone. The Lake Shore & Michigan Southern Railway Company has ordered telephone equipment and is making provision to equip for telephone train dispatching the Youngstown Division of its road, and is making the new Clearfield Branch a part of its telephone system. This is the second circuit on this road to be equipped with Western Electric telephones for train dispatching. The first circuit, between Buffalo and Erie, has been in service more than a year. It is being clearly recognized now by the majority of the larger roads that the telephone has passed the experimental stage for this class of service.

IMPEDIMENTS TO AMERICAN EXPORT BUSINESS.—A correspondent in Buenos Aires, connected with the electrical industry there, in commenting on the small part played by this country in the import trade of Argentina, points out a number of reasons for the disparity. One of these arises from the metric system being employed in that country and the dislike of engineers and others to consider offers based upon the English system owing to the annoyance of translation into the metric system. Another reason is that, unlike European manufacturers, American manufacturers will not consider the specific needs and the tastes of South American customers and present material that will appeal to them, but expect that they shall change their ways and adapt themselves to the industrial conditions of the United States as relates to machinery and supplies; and, unlike the Europeans, they do not send commercial representatives versed in the Spanish language and acquainted with Latin customs. A cause of no inconsiderable prejudice is that the greater part of correspondence from the United States is insufficiently postpaid, thereby subjecting the receiver to an expense of 20 cents per letter. Another great impediment to business with this country relates to credits. Many American manufacturers refuse orders unless prepaid, though the goods many not be actually delivered for six months, or make a condition of a very short credit; European houses, on the other hand, do not require payment until from one to six months after actual delivery.

HENRION CARBONS IN AMERICAN MARKET.—The Edward E. Cary Company, 61 Park Place, New York, importer of electrical specialties, is the agent in this country for the lighting carbons manufactured by Fabius Henrion, France, who is known throughout the world as one of the leaders in the French electrical industry. Mr. Cary claims that, owing to the fact that this plant can manufacture enclosed arc-lamp carbons in 12-in. lengths by the use of automatic machinery, it is able to place them on the American market at a much cheaper rate than those that have heretofore prevailed. Before the passage of the new tariff law it was the habit of importers to order carbons in 24-in. lengths, thus securing a material reduction in the rate of duty. Carbons of this size all required hand labor, and they were, therefore, Mr. Cary states, much more expensive than the shorter carbons made by machinery. He claims that the Henrion factory is the only one in the world that has thus far succeeded in eliminating hand labor. It was testified before the Ways and Means Committee last year that carbons 12 in. long for enclosed arc carbons cost to make in this country about $16 to $18 per thousand at the factory. Mr. Cary claims that he can pay the present duty and yet be able to meet the American prices.

WOULD SUPPLY ENERGY FOR SUBWAYS.—The New York Edison Company has written a letter to the Public Service Commission of the First District, requesting an opportunity to present bids at the proper time for the supply of electric energy for operating and lighting any new subway tunnels that may be constructed. The company suggests that when the specifications for new subways are drawn up, in addition to providing for the construction of power plants, they be so drawn as to permit the operating contractor to provide an alternative arrangement under which he may obtain the necessary energy from a generating company already equipped. The Edison Company in this letter says that its generating plants are of large capacity and provided with adequate reserve in every part, and with the latest and most improved types of apparatus for the economical generation of energy. It is suggested that the company would be able to supply power cheaper than an independent operating company could generate it in its own plant. The letter was written simply that the Public Service Commission might not overlook this sort of an arrangement in its provisions for new subways.

ELECTRIC HEATING OF AN APARTMENT HOUSE.—Neville & Bagge, architects, have prepared plans for a 12-story apartment house on Riverside Drive, near 122d Street, New York, which, it is promised, will contain many electrical novelties. The building is being erected by Clinton W. Kinsella, a contractor who has built many handsome apartments in the metropolis. It is said that, in addition to the operation of the passenger elevators and the dumbwaiters by electric power, every apartment will be supplied with an electric vacuum cleaning device, and that the entire heating will be done electrically. Inquiry at the office of Neville & Bagge developed the fact that the plans for the electric heating had not yet been entirely worked out. It is promised, however, to heat each room separately, and as there will be in the building 40 apartments, many of them containing as much as 14 rooms, it will be understood that the undertaking is not a small one.

ELECTRIC ORE UNLOADERS AND MAGNETIC LIFTS.—Extensive improvements, involving nearly half a million dollars, are about to be made by the Maryland Steel Company at Sparrows Point, Md., for the handling of its ore, which arrives in vessels from Cuba and foreign countries, will include two large electrically operated unloaders, each machine having a capacity of 500 tons per hour, or a combined capacity of 1000 tons an hour. The contract for the unloaders has been awarded to the Brown Hoisting Machine Company, of Cleveland, Ohio. Another improvement will be the installation of a lifting magnet of sufficient power to handle eight rails 30 ft. long, weighing 3000 lb., at one time and place them in the car in which they are to be shipped.

PERU (IND.) ELECTRIC MANUFACTURING COMPANY SOLD.—The plant of the Peru (Ind.) Electric Manufacturing Company has been sold to Charles H. Brownell, the heaviest creditor. The plant was sold at a receiver's sale and Brownell secured the plant for $25,000. The plant is said to be worth $40,000. It is understood that new machinery and equipment will be installed in the plant and that the industry will be started up again. The company manufactured porcelains and brass parts and specialties.

IN FAVOR OF TUNGSTEN STREET LAMPS.—The committee recently appointed by the city government of Plainville, Conn., to investigate the relative merits of tungsten lamps and Welsbach gas lamps for street lighting reported last week in favor of the tungstens. The Connecticut Railway & Lighting Company has submitted a proposition to the city to furnish 90 100-watt tungsten lamps for an annual charge of $1,800, and to furnish 10 similar lamps free in place of the 10 16-cp lamps its charter now requires.

AMERICAN DIESEL ENGINE COMPANY.—The American Diesel Engine Company has been purchased by Adolphus Busch, of St. Louis, and the company has been reorganized with J. R. Harris as the manager. W. R. Haynie, who is connected with the company, reports that it has recently obtained orders for two engines each from the Samson Cordage Works, of Boston; from the Gillett Safety Razor Company, of Newark, and the Prairie Pebble Phosphate Company, of Mulberry, Fla., each engine being of 225 hp.

NEW SCHENECTADY SHOP BUILDING.—The General Electric Company has engaged the Stone & Webster Engineering Corporation to construct a reinforced concrete shop building, to be a part of the Schenectady works. The plans are not yet completed but the general dimensions are 80 ft. x 400 ft.

ELECTRIC POWER FOR SOUTHERN COTTON MILLS.—It is reported that the Southern Power Company, of Charlotte, N. C., offers inducements to large cotton mill and other manufacturing plants to build factories at or near the several hydroelectric plants of the company along the Catawba River, in North and South Carolina, where electricity can be supplied without loss in transmission at a very reasonable rate. The first plant thus organized is a $600,000-cotton mill, which will be built near Great Falls, 40 miles southwest of Charlotte, and in which Messrs. Hal Mebane, Robert S. Mebane and others are interested. It is likewise understood that J. B. Duke, largely interested in the Southern Power Company, will be a stockholder in the new mill. This policy gives promise of numerous extensive developments along the Catawba River.

NEW BALTIMORE CONTRACTING FIRMS.—The Howard Jefferson Electric Company has been formed in Baltimore to do electrical contracting in that city. Howard Jefferson was formerly a partner in the electrical firm of J. Frank Kline, of Baltimore. The Rosenfeld Electric Company, which has opened a large store on South Howard Street, Baltimore, is composed of William Rosenfeld and Isidor Bernstein, both of whom were formerly in the employ of Eugene Rosenfeld. Mr. Bernstein was the foreman of Eugene Rosenfeld, while his partner and former employer are brothers.

ADDITIONS TO BELLINGHAM AND NOOKSACK FALLS STATION.—Extensive alterations in the steam and water power plants of the Whatcom County Railway & Light Company, Bellingham, Wash., are to be made by the Stone & Webster Engineering Corporation. In the Nooksack Falls water-power plant an impulse wheel will be substituted for the present 3300-hp Francis turbine. The steam plant, known as the York Street station, will be enlarged to accommodate a new 1500-kw turbo-generator with boilers, condensers and other steam and electrical auxiliaries.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in our present issue are announcements of proposed new plants or considerable extensions of present plants at Greenfield, Mass.; Frankfort, Ky.; Philadelphia, Pa.; Elkhorn, Wis.; Durham, N. C.; Dalhart, Tex.; Bentendorf, Ia.; South Platte, Col.; Sikeston, Mo.; Ansonville, N. C.; Bracebridge, Ont., Can.; Bedford, Ind.; Verdun, Que., Can., and Grand Junction, Col.

Financial Intelligence.

THE WEEK IN WALL STREET.

The past week in the Wall Street market has been one of uncertainty and irregularity. Trading has been only moderate, and there has been an absence of that enthusiasm which has marked the earlier weeks of the fall. After several days of decline and liquidation, prices on Oct. 23 reached, for many stocks, the lowest figures recorded since midsummer. The close on that date was weak, and the situation discouraging. On Monday, Oct. 25, there was a sharp recovery, renewed activity in trading and advances that amounted in most cases to several points. The secret of this erratic behavior is that the market has been entirely dominated by the money market. When the banks of Germany and England put up their discount rates and quotations on call, money in New York advanced to 5 per cent, there was much enforced liquidation and widespread anxiety as to what the future held in store. Traders became careful about long commitments, bankers became conservative and indicated a strong disposition to curtail loans. This was the condition at the lowest point and then came the sudden improvement. When the market opened on Oct. 25, it was found that the conditions of the foreign banks was so much improved that further advances were unlikely, local money rates became easier, with bankers in more liberal disposition. The immediate recovery that followed but emphasized the fact that the only check to the long upward march had been the money market. Relieved of this restraining influence the market again displayed its buoyant tendencies. And why not? Commercial and industrial business continued to improve and the promise that 1910 will be a banner year is still alluring. Stocks may have been for many months too high for the level of business, but it is hardly reasonable to calculate that as business improves stocks will recede. With a tight money market liquidation and reactions are necessary, but there will be no permanent demoralization during a business boom. Money on Oct. 25 was quoted: Call, 3½ @ 4½ per cent; 90 days, 4⅞ @ 5 per cent. The quotations in the table are those of the close Oct. 25:

NEW YORK.

	Oct. 18.	Oct. 25.	Shares sold		Oct. 18.	Oct. 25.	Shares sold
All.-Ch.	15¼	14½	1,345	Int.-Met., pfd.	51½	49¼	65,420
All.-Ch., pfd..	53⅜	50⅛*	4,700	Mackay Cos..	93	90¼*	1,300
Amal. Cop....	84⅛	81¾	262,860	MackayCos.,p.	76¼	76*	580
Am. D. T....	20½*	20½*	———	Man. Elev...	142	142*	600
Am. Loc.	60	58¼	4,000	Met. St. Ry..	20*	20*	———
Am. Loc., pfd.	115*	116*	550	N.Y.&N.J.Tel.	139¼*	139¼	———
Am. Tel. & Cbl.	85*	85*	———	Steel, com...	91¼	89⅛	1,518,140
Am. T. & T..	142	140¼	17,500	Steel, pfd....	128⅛	126¾	28,590
B. R. T.....	78¾	76¾	18,300	W. U. T.....	77½	76½	4,700
Gen. Elec.....	164⅜	160⅛	520	West'h, com..	86½	84½	3,400
Int.-Met., com.	18⅞	17½	153,682	West'h, pfd..	140*	140*	100

PHILADELPHIA.

	Oct. 18.	Oct. 25.	Shares sold		Oct. 18.	Oct. 25.	Shares sold
Am. Rys.....	45⅛*	45¾	———	Phila. Elec...	13¼	13	———
Elec. Co. of A.	12¼	12½	———	Phila. R. T..	27⅜	25½	———
Elec. St. B'ty.	60¼	59	———	Phila. Trac...	89*	89½	———
E. S. B'ty, pfd.	30*	30*	———	Union Trac..	53	52	———

CHICAGO.

	Oct. 18.	Oct. 25.	Shares sold		Oct. 18.	Oct. 25.	Shares sold
Chi. City Ry..	180*	180*	———	Chi. Tel. Co.	136½*	136½	———
Chi. Rs.,Ser.1.	109¾*	108*	———	Met. Ey., com.	17¾*	17¾*	———
Chi. Rs.,Ser.2.	35½	35½*	———	Met. El., pfd.	51½	51*	———
Com. Edison..	120½	119½	———	Nat'l Carbon.	98½*	98*	———
Chi. Sub'ws...	8¼	7⅛	———	Nat'l C., pfd.	120*	120*	———

BOSTON.

	Oct. 18.	Oct. 25.	Shares sold		Oct. 18.	Oct. 25.	Shares sold
Am. T. & T...	141⅞	140¼	———	Mex. Tel....	2½	3	———
Cum. Tel.....	143¼	145*	———	Mex. Tel.,pfd.	6*	6	———
Edison E. Ill..	250*	252	———	N. E. Tel...	136½	134½	———
Gen. Elec.....	164¼	160	———	W. T. & T..	10*	10*	———
Mass. E. Ry..	17¾	17	———	W. T. & T., p.	89*	88*	———
Mass. E. R.,p.	81	80*	———				

*Last price quoted.
Shares sold are for week ot Oct. 18 to Oct. 23.

ROCKINGHAM (N. C.) POWER COMPANY.—In the decision of the North Carolina Supreme Court in the case of Worth vs. Knickerbocker Trust Company, of New York, an important step in the fight for control of the extensive holdings and interests of the Rockingham Power Company is achieved. In the complaint, Mr. Worth alleged that he had taken stock in the Rockingham company, and also bonds of the company, and that the Knickerbocker Trust Company had secured control of a majority of the stock of the power company and "had formed a voting trust" to control the business management, etc., of the power company. The plaintiff further alleges that the defendant company entered into improvident contracts with other companies and had rendered the Rockingham Power Company insolvent, so the allegation sets forth. The Knickerbocker Trust Company asked that the action be dismissed and that an attachment on their property be discharged. In the lower court this request was granted to the extent of reducing the attachment to $50,000. The trust company appealed to the State Supreme Court asking that the lower court be reversed and the action dismissed. The higher court now upholds the lower court, and holds that the attachment was properly made, and that there was good cause for action. This decision throws the case back into the State court in New Hanover County for a jury to decide to what amount of damages, if any, Mr. Worth is entitled.

CHICAGO & MILWAUKEE ELECTRIC RAILWAY.—An order granting the receivers of the Chicago & Milwaukee Electric Railroad Company the power to buy 17 new cars at a cost of $135,000 and to sell 19 old cars for $29,000 was made on Oct. 19 in the United States Circuit Court in Chicago. Counsel for the receivers argued that the company's business had increased 63 per cent during the last year, compared with the year before, making the purchase of additional equipment necessary. The total receipts for April, May, June and July, 1909, were $299,024.08, as compared against $183,298.95 for the corresponding months of 1908. Expenses for these two periods were, respectively, $180,343.66 and $133,610.33. Thus the receipts are shown to be increasing at a considerably faster rate than the expenses.

AURORA, ELGIN & CHICAGO RAILWAY.—At the annual meeting of the Aurora, Elgin & Chicago Railroad Company on Oct. 19 the old directors were re-elected. The financial report shows a reduction in the ratio of operating expenses. Gross receipts were $1,411,722, an increase of $50,536, while operating cost was $706,270, a gain of only $8,001 compared with the previous year. The net income was $329,617, an increase of $42,694, which equals 5.63 per cent on the common stock. During the year the company paid 5 per cent on $3,100,000 preferred and 3 per cent on a like amount of common stock outstanding.

INDEPENDENT TELEPHONE INTERESTS NOT SOLD OUT.—In our last issue we gave the details of the organization of the Ohio Home Telephone Company, of Cleveland, which was incorporated as a holding company for the Independent telephone interests in the Middle West. It was stated that this company would take over the property of the United States Telephone Company, of Cleveland, under a 99-year lease. Details were also given of the purchase by James S. Brailey, Jr., of the controlling interests in the Ohio, United States and the Cuyahoga telephone companies, all large Independent concerns. Within the last week the publication was made at Toledo, and sent over the entire country, that through Mr. Brailey the Independent telephone interests of the Middle West had been sold out to the Bell people. It was stated that the Bell interests through options had secured entire control of the Independent companies in that section of the country. On Oct. 23 Mr. Brailey issued a signed statement in which he said: "There is absolutely no truth in the statement that the Bell company had acquired an interest in any of the properties with which I am associated." He further said that he had been working on the plans for the new Independent syndicate for two years, and that he had completed its financial arrangements and was ready to unify the Independent interests. He said that the United States Telephone Company was going ahead with its development work, and would put in a new No. 8 copper circuit between Columbus and Toledo and between Columbus and London. He said that everything would be done in his power to protect the Independents from absorption by the Bell interests.

TELEPHONE MERGER HALTED.—Vice-Chancellor Howell at Trenton, N. J., last week granted an order restraining the transfer of any of the property or securities of the Interstate Telephone Company to the American Telephone & Telegraph Company, or to any of the subsidiary corporations comprising the Bell system, and restraining the American company or its subsidiaries from taking any steps to acquire control of the Interstate company. The Interstate Telephone Company is an independent, which has been operating in New Jersey, and has heretofore had no connection with the Bell interests. It has been operated directly in connection with the Consolidated Telephone Company and the Keystone Telephone Company, of Philadelphia. It is stated that about 78 per cent of the stock of the company had been deposited under a pooling agreement, and that it was this interest that the American company had prepared to take over. Inquiry at the office of the American company in New York brought out the fact that this restraining order in no way affected the consolidation of interests that has recently been going on among the large Bell companies. The New York Telephone Company and the New York & New Jersey Telephone Company are in no way affected by this restraining order, which applies only to the independent.

DES MOINES CITY RAILWAY COMPANY.—The property of the Des Moines (Ia.) City Railway Company, and of the subsidiary railways which operate under this company's control, was sold Oct. 22 to W. B. McKinley, of Champaign, Ill., for $6,500,000. It is stated that in this enterprise Mr. McKinley is backed by Canadian capital. He already is the president and principal owner of the Illinois Traction System, which operates 530 miles of electric lines in the northern portion of Illinois, and has six power plants and 600 cars. As soon as Mr. McKinley took charge of the Des Moines property he made application to the City Council for a 25-year franchise, under an agreement to expend $1,500,000 in improvements within the next five years.

PHILADELPHIA RAPID TRANSIT CONTRACT.—An effort is being made in Philadelphia to annul the contract which was made some months ago between the city and the Rapid Transit Company. Both branches of the City Council have adopted resolutions looking toward the annulment of this contract. It is said that a petition bearing the signatures of 58,178 voters has been presented to the Council insisting upon an immediate restoration of the strip tickets, or six-for-a-quarter rate. The matter is being made a political issue, and the Rapid Transit company is being drawn into politics in spite of itself.

INTERNATIONAL STEAM PUMP BONDS.—William Salomon & Company are offering an issue of $8,500,000 of International Steam Pump Company bonds. These bonds are being offered in London at the same time. The subscription price is 96½ and interest, at which the yield will be about 5.30 per cent. The purpose of these bonds is to furnish funds for plant extension and to add to the working capital of the company. After some other indebtedness is retired on Oct. 28 these bonds will constitute the only funded debt of the International Steam Pump Company.

GENERAL MOTORS COMPANY.—At the annual stockholders' meeting of the General Motors Company in Jersey City, H. G. Hamilton was elected a director to succeed F. L. Smith and J. T. Smith was elected to take the place of H. Russell. Otherwise there were no changes in the board.

SPRING GROVE TELEPHONE COMPANY.—The capital stock of the Spring Grove Telephone Company, of Richmond, Ill., has been increased from $10,000 to $20,000, and the name has been changed to the McHenry County Independent Telephone Company.

DIVIDENDS.

Amalgamated Copper Company, quarterly, ½ per cent, payable Nov. 29.

American Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Nov. 1.

The J. G. Brill Company, preferred, quarterly, 1¾ per cent, payable Nov. 1.

Edison Electric Illuminating Company, Brockton, Mass., semi-annual, 3½ per cent, payable Nov. 1.

Helena (Mont.) Light & Railway Company, quarterly, preferred, 1¼ per cent, payable Nov. 15; common, 1 per cent, payable Nov. 1.

Michigan State Telephone Company, quarterly, preferred, 1½ per cent, payable Feb. 1; common, 1½ per cent, payable Dec. 1.

Montreal Light, Heat & Power Company, quarterly, 1¾ per cent, payable Oct. 31.

United States Electric Securities Company, preferred, semi-annual, 3½ per cent, payable Nov. 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Changes.	Surplus.
Aurora, Elgin & Chicago Railroad Company:					
Year ended June 30, 1909	$1,411,722	$796,270	$615,452	$341,327	$329,617
Year ended June 30, 1908	1,361,186	788,268	572,918	333,700	286,922
Brockton & Plymouth (Mass.) Street Railway Company:					
August, 1909	17,911	11,194	6,716	1,661	5,055
August, 1908	16,515	9,275	7,239	2,212	5,027
Electric Light & Power Company, of Abington & Rockland, Mass.:					
August, 1909	6,410	3,829	2,581	477	2,103
August, 1908	4,396	2,802	1,593	354	1,239
Fairmount & Clarksburg Traction Company:					
July, 1909	39,899	13,356	26,543	1,892	28,340
July, 1908	35,462	12,315	23,146	1,069	24,393
Houghton County (Mich.) Electric Light Company:					
August, 1909	18,439	9,615	8,824	3,640	4,702
August, 1908	16,637	9,273	7,364	3,309	3,681
Keystone Telephone Company, Philadelphia:					
September, 1909	91,908	45,070	46,838	33,015	13,823
September, 1908	87,656	42,873	44,783	34,445	10,338
Lexington (Ky.) & Interurban Railways Company:					
July, 1909	54,238	34,720	19,517	——	——
July, 1908	58,706	37,495	21,211	——	——
Norfolk & Portsmouth Traction Company:					
July, 1909	180,277	101,163	79,064	——	——
July, 1908	181,804	98,326	83,478	——	——
United Railways of St. Louis:					
September, 1909	929,329	589,357	339,972	232,132	107,840
September, 1908	887,344	554,164	333,180	234,380	98,800
Whatcom County (Wash.) Railway & Light Company:					
August, 1909	36,841	19,174	17,666	8,063	9,602
August, 1908	29,417	17,267	12,149	7,976	4,172

GENERAL NEWS

Construction News.

BESSEMER, ALA.—Plans have been prepared by D. O. Whilldin, Title Guarantee Building, Birmingham, Ala., for the construction of a building 140 x 30 ft., for the Birmingham Light & Power Company, of Birmingham, Ala.

BRENT, ALA.—Plans are being considered by the Thompson Lumber Company for construction of a mill to replace the one recently destroyed by fire. It is said that a Corliss engine or steam turbine will be installed and probably electrical apparatus will be required.

CARBON HILL, ALA.—It is reported that an election to be held Oct. 30 the citizens will vote on the proposition to issue $25,000 in bonds for the construction of an electric light plant and water works system.

BISBEE, ARIZ.—Plans are being made by the Bisbee Improvement Company for the reconstruction of the local telephone system. The central battery system will be installed.

ARKANSAS CITY, ARK.—A contract has been awarded by the Land & Power Company, which owns and controls the Arkansas City Gas & Electric Company, amounting to $21.000 to the Allis-Chalmers Company, of Milwaukee, Wis. The contract calls for a new steam turbine and generator, also a separate generator, and two boilers and condenser. It is understood that the Southwestern Interurban Railway Company is contemplating making extensions to its system next spring. The power company furnishes electricity for operating the railway system.

MAMMOTH SPRINGS, ARK.—The Montgomery telephone system in Fulton County has been purchased by Lehman Kay, of Salem, and H. A. Northcutt. The new owners propose to extend the system from Mammoth Springs to various points in the county.

ALAMEDA, CAL.—The contract for finishing the power house of the Southern Pacific Company, which is being erected on the north side of the tidal canal between Park Street and Fruitvale Avenue drawbridge, has been awarded to F. P. Fisher, of Alameda, for $127,000. The station will furnish electricity for operating the passenger traffic of the Southern Pacific Railroad in the east bay cities, which will be changed from steam to electric power.

AUBURN, CAL.—O. T. Crites, local manager of the Pacific Telephone & Telegraph Company, states that his company will, within the next few months, put in a complete new telephone system in Auburn, which will entail an expenditure of about $35,000. All the overhead wires will be replaced with cables. The telephone exchange will be equipped with the central-battery system.

AUBURN, CAL.—The Board of Supervisors has granted Dr. Robert Peers, of Colfax, Cal., medical director of the Colfax School for tuberculosis, permission to erect and maintain a transmission line for the distribution of electricity for lamps and motors along the county road between Colfax and Auburn. Permission was also granted by the board for the erection of a telephone line between Colfax and the school.

BAKERSFIELD, CAL.—J. F. Stratton, vice-president and general manager of the Westside Electric Company, states that the company expects to have its plant in operation by Nov. 1. Westinghouse 2300-volt generators will be installed and the company is now making contracts to supply electricity to operate oil leases. The main office of the company will be located at Maricopa.

CORNING, CAL.—The County Commissioners have granted the Sacramento Power Company a franchise to operate its system in Tehama County.

FRESNO, CAL.—The Fresno Traction Company has applied to the Board of Supervisors for a franchise to construct an electric railway on First Street, from Tulare Avenue to Kern Avenue, bids for which will be opened on Nov. 11.

FRESNO, CAL.—Notice of appropriation of water of the middle fork of the Kings River in the Sierra forest reserve to the extent of 100,000 cu. in., to be utilized to generate electricity for commercial purposes, has been filed by Charles McBride.

FRESNO, CAL.—A. S. Wisbon, manager of the San Joaquin Light & Power Company, states that this corporation will next year furnish electricity for irrigation to all the foothills along the eastern portion of this section. An order will be placed soon for equipment for a 17,000-hp plant to be installed in Crane Valley by next May.

LOS ANGELES, CAL.—M. A. King has filed a petition asking the City Council to offer for sale to the highest bidder a 21-year franchise to construct and maintain a conduit system for carrying cables and wires on certain streets in the city of Los Angeles.

LOS ANGELES, CAL.—The City Council has adopted the recommendation of Mayor Alexander and has instructed the city attorney to prepare an ordinance calling for an election to be held Jan. 26 to vote on the proposition to issue $3,500,000 for the development of the Owens River project and $3,000,000 for harbor work.

OAKLAND, CAL.—The application of the Great Western Power Company for permission to erect a transmission line along Fifth Avenue has been refused by the Board of Public Works. The request was denied owing to the objection of erecting overhead wires in that section of the city. The board instructed the company to decide upon another route. Mayor Mott is in favor of the city installing its own conduit system and leasing space to the power, telephone and telegraph companies.

OROVILLE, CAL.—It is reported that surveys will soon commence on the large power development of the Feather River Power & Development Company on the middle fork of the Feather River. The plan includes a chain of three plants, by which it is estimated that 86,000 hp can be developed at low water. The first diversion of the water will be made at Nelson Point, in Plumas County, where 15,000 cu. in. of water will be carried 11 miles in a ditch to the mouth of Onion Creek where a fall of 1,000 ft. will be secured for the first plant. From this pond the water will be carried by a ditch, now increased to 20,000 cu. in., a distance of 14 miles, to a point near the mouth of South Branch, where a fall of 1,250 ft. will be had for the second power plant. From the second plant the water will be increased to 25,000 cu. in. and will be carried in a ditch six miles to Fall River, where a fall of 720 ft. will be secured for the third plant. H. O. Lague is manager and engineer.

OROVILLE, CAL.—General Manager H. H. Sinclair, of the Great Western Power Company, recently visited Oroville in company with Assistant General Manager George R. Field, H. W. Buck, J. R. Freeman, of Providence, R. I.; W. O. Crosby, of Boston, Mass., and A. P. Davis, of Washington, D. C., for the purpose of making preliminary arrangements for the construction of the permanent dam which the company is to erect at the intake, work on which, it is said, will be started next year after the heavy rainfall of the season is over. That the company has made any working agreement with the Pacific Gas & Electric Company, the Oro Water, Light & Power Company, or any other competing company, is denied absolutely by Mr. Sinclair.

PLACERVILLE, CAL.—It is reported that the Southern Pacific Company is making preparations for the construction of a large dam and power house in the upper region of the Rubicon River, in Placer County, the water-power to be utilized to generate electricity.

SACRAMENTO, CAL.—The Postal Telegraph Company has been granted permission by the city trustees to place its wires underground on certain streets in the city.

SACRAMENTO, CAL.—The city is negotiating with the Great Western Power Company to furnish electricity to operate its sewer pumping and water works plants. The main transformer station at Brighton is practically completed, but as yet nothing has been done towards the construction of the distributing station to be located at Eighth and R Streets.

SAN BERNARDINO, CAL.—Estimates are now being received by Seth Marshall for the Arrowhead Hotel Company for the installation of an electric light plant to furnish electricity for the hotel and grounds. The plant is to be installed immediately.

SAN FRANCISCO, CAL.—A certificate acknowledging the $12,000,000 increase of bonded indebtedness of the Sunset Telegraph & Telephone Company, voted at the directors' meeting held at Martinez July 7, has been filed with the county clerk, of which $6,500,000 will be used for new equipment, the balance in retiring outstanding debts.

SAN FRANCISCO, CAL.—The contract for construction of the substation of the Sierra & San Francisco Power Company, in Visitacion Valley, south of San Francisco, has been awarded to Duncanson & Haroldson. The United Railroads of this city will receive electricity through this station from the Stanislaus Power Company's plant.

WILBUR SPRINGS, CAL.—We are informed that plans are being considered for the installation of a lighting plant at the Wilbur Hot Sulphur Springs. Electric, gasoline and acetylene plants are under consideration, with a preference for electricity, if it can be installed advantageously. For further information address J. W. Cuthbert, Wilbur Springs, Cal.

YREKA, CAL.—The Siskiyou Electric Power & Light Company's transmission line from the power plant on Fall Creek to Dunsmuir is practically completed. The line is 65 miles in length and will furnish electricity for lamps in the towns of Dunsmuir, Sisson, Weed and intermediate stations. The company now has about 200 miles of transmission line, serving, in addition to the towns named, Yreka, Ashland, Montague, Hornbrook, Fort Jones, Greenview and Etna. The company supplies electrical power for several mines and dredgers as well.

ASPEN, COL.—Electrical pumps are being installed in the free silver shaft of the Smuggler mine.

BUENA VISTA, COL.—Preliminary plans have been filed with the county clerk by the Arkansas Flue & Ditch Company for a large power project, which will involve an expenditure of about $2,500,000. The plans call for the construction of a canal 42 miles in length, extending from the mouth of the Arkansas River, a mile east of Salida to Parkdale, and will carry 600 cu. in. of water per second. Four power stations will be erected along the canal, and each will have a head of 275 ft. of

water. It is said that the company also proposes to furnish water to the towns through which the canal passes. A. P. Hiatt, E. W. Tomlinson and Peter O'Brian, of Canon City, Col., are interested in the company.

DENVER, COL.—Plans are being considered by the Colorado & Southern Railway Company to broaden the gage and equip its railroad to be operated by electricity from Denver to Morrison, a distance of 16 miles.

DENVER, COL.—Preparations are being made by the Northern Colorado Power Company for doubling the output of its plant at Lafayette, plans for which are being prepared by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.

GRAND JUNCTION, COL.—The Grand Junction Gas & Electric Company is reported to have awarded contracts for new machinery which will involve an expenditure of $60,000 and which will double the present output of its plant. It is said that the company is preparing to supply electricity to operate the proposed interurban electric railway when completed.

SOUTH PLATTE, COL.—Plans and specifications have been prepared by the South Platte Power Company for the construction of a large power plant at Mill Gulch, located about 20 miles from Denver, Col. The cost of the plant is estimated at from $1,500,000 to $2,000,000, contracts for construction of which, it is said, will probably be let in the near future. The plans include the construction of transmission lines to Castle Rock, Littleton, Platte Canyon summer resorts and all surrounding territory, including a line to the city limits of Denver. The South Platte Power Company is reported to have been negotiating with the officials of the Colorado & Southern Railroad Company regarding the furnishing of electricity to operate the South Park division, if it is decided to equip the railway to be operated by electricity. Godfrey Schirmer, of the German-American Trust Company, Adolph Zang, Albert Jahl and others are interested in the project.

PLAINVILLE, CONN.—The committee recently appointed to investigate the relative value of the tungsten electric lamp and the Welsbach gas lamp for street lighting purposes has reported in favor of the tungsten lamp. The Connecticut Company has submitted a proposition to the town offering to furnish ninety 100-watt tungsten lamps for the annual appropriation of $1,800, and to furnish ten lamps on Whiting Street, free of charge, where it is now supposed to furnish 16-cp lamps under the agreement of its charter. The company has been endeavoring to secure the contract for street lighting for several years, and it is probable that the gas street lamps will be replaced with tungsten lamps.

WILMINGTON, DEL.—The contracts for electrical wiring and installation and for motor-generator set at the new filter plant were awarded to the Garret-Miller Company, of Wilmington, Del., for $5,605.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 20, for one 75-kw engine driven generator set. Plans and specification can be obtained on application to the above named bureau. R. C. Hollyday is chief of the bureau.

CUTHBERT, GA.—The citizens have voted to issue $20,000 in bonds, the proceeds to be used for improvements to the electric light plant and water works system.

ELBERTON, GA.—The State Railroad Commission has authorized the Interstate Power Company, of Elberton, Ga., to issue $6,000,000 in capital stock and an equal amount in bonds, the proceeds to be used for a water-power development in Savannah River, near Elberton, Ga.

WAYCROSS, GA.—At an election held recently the city is reported to have voted against the proposition to issue $45,000 in bonds for an electric light plant.

CHICAGO, ILL.—The City Council is preparing an ordinance under which the railway companies will be compelled to change their motive power within the city limits from steam to electricity.

CHICAGO, ILL.—The North Chicago Railway Company, which has applied to the Secretary of State for a charter, will, it is said, take steps immediately to obtain a franchise from the City Council. The company proposes to take over the property of the Consolidated Traction Company on terms to be decided upon by the reorganization committee with the security holders.

CLINTON, ILL.—The construction of an electric light plant and water works system in Clinton is reported to be under consideration. L. W. Lemon is city engineer.

NAPERVILLE, ILL.—Plans are being considered for making improvements to the municipal electric light plant. Frank Strubler is chairman of light committee.

PEORIA, ILL.—The Farmers' Mutual Telephone Company has decided to increase its capital stock from $20,000 to $40,000.

ROCK ISLAND, ILL.—The Union Electric Telephone Company has petitioned the City Council for permission to install conduits in the down-town district for the purpose of placing its wires underground.

STREATOR, ILL.—The 90-day time limit granted by the City Council to the Central Light, Heat & Power Company in which to accept the franchise granted three months ago has expired and has been pronounced null and void by Mayor Lucey. Representatives of the company have filed petitions with the city clerk asking that the time be extended 90 days, but it is not expected that it will be granted.

AURORA, IND.—Work has been commenced by the Engineering & Equipment Company, of Aurora, Ind., on the construction of the proposed interurban electric railway connecting Aurora and Rising Sun. It is understood that power-house equipment, including oil engines, generators, etc., and also roadway material will be purchased.

BEDFORD, IND.—We are informed that bids will probably be asked in about 30 days by the Bedford Power Company for construction of its proposed power plant in White River, at a cost of about $350,000. The Mansfield Engineering Company, Board of Trade Building, Indianapolis, Ind., has charge of the work.

COLUMBUS, IND.—Preparations are being made by the Indianapolis, Columbus & Southern Traction Company to replace about 40 miles of 2-0 wire round trolley with 4-0 grooved wire, between Indianapolis and Columbus, Ind., work on which will begin in a short time. The company will also reconstruct its high-tension transmission line extending from Greenwod to Reddington, a distance of about 45 miles. C. O. Anderson is general manager.

INDIANAPOLIS, IND.—The Capital Circuit Traction Company has secured practically all of the right of way, and surveys have been completed for its proposed electric railway connecting Greensfield, Fortville, Sheridan, Lebanon, Fountaintown and intervening towns. It is said that the company expects to place contracts as soon as the road is financed. J. N. Crabb, 1019 Law Building, Indianapolis, Ind., is president of the company.

MONROE, IND.—The question of establishing an electric lighting service in Monroe is under consideration.

WARSAW, IND.—Announcement has been made that work will be commenced at once by the Wabash & Northern Indiana Traction Company on its proposed electric railway from Wabash to Warsaw. Subsidies amounting to $57,500 have been voted in the townships of Wabash and Kosciusko for the railway company. J. A. Barry is said to be interested in the project.

ALBIA, IA.—The Albia Interurban Railway Company is planning to build a nine-mile extension to its railway next year. W. E. Gant is manager.

BETTENDORF (D. O. DAVENPORT), LA.—At a special election held Oct. 15 the citizens voted to grant the Bettendorf Improvement Company a franchise to construct and operate an electric light plant and water works system. The company, it is said, will commence work on construction of the plants at once.

COUNCIL BLUFFS, IA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 26 for installing a lighting and conduit system in the United States post office and court house and extension in Council Bluffs, Ia., in accordance with drawings and specifications, copies of which can be had at the above office, or at the office of the superintendent of construction, Council Bluffs, Ia. James Knox Taylor is supervising achitect.

DECATUR, IA.—The Leon Electric Light Company, of Leon, Ia., has submitted a proposition to the Town Council offering to extend its transmission lines from Leon to Decatur to furnish electricity for lamps and motors in this town, provided a franchise is granted to the company. A special election will be held Nov. 13 to vote on the question of granting the franchise.

DES MOINES, IA.—The Des Moines & Sioux City Railroad Company is reported to have awarded the contract for the construction of its proposed electric railway from Des Moines to Sioux City, a distance of 196 miles, to the American National Corporation, of Indianapolis, Ind. John P. O'Malley, of Perry, Ind., is president of the company.

DES MOINES, IA.—The property of the Des Moines City Railway Company and subsidiary railways was sold Oct. 22 by W. B. McKinley, of Champaign, Ill., representing insurance interests in Canada, for $6,500,000. Application was made to the City Council by the new owners for a 25-year franchise under an agreement to expend $1,500,000 in improvements within the next five years.

FRONTENAC, KAN.—The question of installing water works, pumping plant and electric lighting plant in Frontenac is under consideration. Mayor Beitsinger is said to be in favor of the proposition.

ST. JOHN, KAN.—Marshall Brothers, of Las Animas, Col., have secured the contract for the construction of the municipal electric light plant and water works system, for $12,025. Contracts for machinery and equipment have also been awarded.

FRANKFORT, KY.—Bids will be received by the Board of Regents of Kentucky Normal and Industrial Institute, care of Anderson & Frankel, engineers, Lexington, Ky., until Nov. 17, as follows: (1) Heating plant, including boiler-room equipment and heating pipes and radiation, etc. (2) Engine, generator, switchboard and electric wiring and fixtures, etc., and lighting the campus. (3) Gasoline engine. The above plant is to heat and light the Trades Building and Auditorium Building located on the campus of the Kentucky Normal and Industrial Institute, located near Frankfort, Ky. Plans and specifications may be seen at the office of the State Superintendent of Public Instruction, Frankfort, Ky., and at the office of Anderson & Frankel, engineers, Frankfort, Ky. J. G. Crabble is chairman.

PARIS, KY.—The Paris Electric Light Company has applied to the City Council for a 20-year franchise to furnish a day service for lamps, heat and motors. The company, it is said, proposes to install a new plant. The Council has passed an ordinance directing the sale of the franchise to the highest bidder.

NEW IBERIA, LA.—The City Council has authorized an election to be held Nov. 16, at which the people are to vote on the proposition of leasing the municipal electric light plant and water works system to private parties for a term of years or to appropriate funds for rebuilding the present plants. The vote will also include a proposition to amend the city charter so as to give the city authority to sell the plant and grant franchises to private parties. The cost of rebuilding the plants is estimated at $60,000.

PORTLAND, MAINE.—Bids will be received by the Commissioners of Cumberland County, until Nov. 1 for special electric fixtures for the new county building, plans and specifications for which may be seen at the office of George Burnham, architect, 120 Exchange Street, Portland, Maine. All bids must be made out on blanks furnished by the commissioners. James H. McDonald, Edward H. Trickey and James Carroll Mead are commissioners.

WASHBURN. MAINE—The Washburn Electric Company has been granted permission to erect transmission lines in Washburn. E. M. Hines is president and manager of the company.

WATERVILLE, MAINE.—The committee on public buildings has awarded a contract to the Waterville & Fairfield Railway & Lighting Company to furnish electricity for lighting the city hall and armory.

BOSTON, MASS.—Owing to the refusal of the Edison Electric Illuminating Company of Boston to grant a lower rate for furnishing electricity for lighting the school buildings the school committee is contemplating installing electric generating plants in various parts of the city to furnish electricity for private use as well as for the city buildings. The board claims that many of the school buildings could be equipped with generating plants with but little additional expense. Application will be made to the State Legislature for permission to extend wires across the streets to connect groups of school buildings. The school board has asked the Merchants' Association to investigate the cost of electricity for school buildings.

GREENFIELD, MASS.—Extensive improvements are to be made to the power plant of the Greenfield Electric Light & Power Company, which will include the construction of a new boiler house of sufficient size to accommodate five boilers. A new steam turbo-generator set with a rating of from 750 to 1000 kw is to be installed. It is said that the old generators will be replaced with new machines as fast as possible.

MARBLEHEAD, MASS.—It is reported that the municipal committee has recommended to the Council that an appropriation of $28,000 be made for improvements to the municipal electric light plant, of which $13,000 would be used for new equipment.

ROWLEY, MASS.—The question of establishing an electric lighting system in Rowley is under consideration.

MANISTEE, MICH.—The Manistee County Electric Company has been granted a franchise by the Board of Supervisors of Manistee County to erect seven dams on the Manistee River and its tributaries. It is expected that work will commence on the construction of the first of these dams immediately.

DULUTH, MINN.—The Council is reported to have approved the lighting scheme for East Superior Street.

MARSHALL, MINN.—The Northwestern Telephone Exchange Company is contemplating rebuilding and improving its system.

McKINLEY, MINN.—It is reported that the citizens have voted to issue $5,000 in bonds, the proceeds to be used for the construction of an electric light plant.

NASHWAUK, MINN.—The City Council has awarded to the Richardson Electric Company for $1,970 the contract for the installation of a Lycoming simple automatic engine, direct-connected to a Burke, three-wire, 110-220-volt, direct-current generator.

VIRGINIA, MINN.—Plans have been prepared by W. A. Wilkinson, architect and engineer, Security Bank Building, Minneapolis, Minn., for the construction of a power house and planing mill for the Edward Hines Lumber Company.

GLASGOW, MO.—At an election held recently the proposition to issue $30,000 in bonds, the proceeds to be used to purchase the local electric light plant and for improvements to the water works system, was carried.

SAVANNAH, MO.—At an election held recently the citizens are reported to have voted in favor of issuing $7,500 for the construction of an electric light plant.

SIKESTON, MO.—The Sikeston Ice, Light & Power Company is considering the installation of a 150-kw, two-phase, 60-cycle alternator direct-connected to a cross-compound, medium speed, condensing engine, together with a condenser; also an additional boiler, 66x18, high pressure type, and stoker equipment for three boilers. C. L. Clary is general manager.

BUTTE, MONT.—Plans are being considered by the Montana Independent Telephone Company for the erection of a telephone line from Whitehall and Twin Bridges to Virginia City.

HAMILTON, MONT.—The City Council is considering extending the electric lighting system to the Riverview addition.

HELENA, MONT.—A temporary injunction has been issued by Judge J. Miller Smith restraining the city of Helena from proceeding with its plan to establish a municipal electric light plant. Bids for installing the plant have already been received.

AINSWORTH, NEB.—A stock company is reported to have been formed for the purpose of building a dam at Plum Creek, 15 miles northeast of Ainsworth, the water power to be utilized to generate electricity which will be transmitted to Ainsworth. F. W. Sellars is president of the company, and Walter Williams, secretary.

BEATRICE, NEB.—The New Home Telephone Company is reported to have purchased the controlling interest in the Filley Telephone Company. It is said that many improvements are proposed to the system.

BOELUS, NEB.—The capital stock of the Howard County Telephone Company has been increased from $24,000 to $34,000, the proceeds to be used for extension of telephone lines and discharging outstanding indebtedness.

BROKEN BOW, NEB.—O. P. Sells, of Sterling, Col., is reported to have applied to the City Council for a franchise to construct and operate an electric light plant in Broken Bow.

LOUISVILLE, NEB.—Preparations are being made by the Plattsmouth Independent Telephone Company to erect a new exchange building.

STROMSBURG, NEB.—The State Railway Commission has authorized the Polk County Telephone Company to increase its capital stock from $66,875 to $74,875, for the purpose of extending its lines and payment of outstanding obligations.

BRIDGETON, N. J.—Bids will be received by Frank L. Hewitt, city clerk, until Nov. 2, for lighting the city for a term of five years, beginning December, 1909.

CALDWELL, N. J.—The Borough Council has voted to accept the new light contract submitted by the Public Service Commission for street lighting for a term of three years, dating from March, 1909. Under the terms of the contract the borough is to pay $16 per lamp the first year for 32-cp incandescent lamps, $18 for the second year and $20 for the third year. Under the new contract no free lamps will be furnished.

CAMDEN, N. J.—The Delaware Tunnel Railroad Company has been granted a franchise by the City Council to enter Camden with its rapid transit railway. The proposed railway will extend from Philadelphia, Pa., to Camden under the Delaware River. William A. Stern, of Philadelphia, Pa., is president of the company.

KEYPORT, N. J.—The Jersey Central Traction Company has awarded a contract for its proposed extension through South Amboy to Perth Amboy, 2½ miles in length, to the General Contracting & Engineering Company, of New York, N. Y.

PLAINFIELD, N. J.—Bids will be received by F. A. Waldron, engineer, 37 Wall St., New York, N. Y., on the following equipment: One direct-current, 40-kw, 220-volt generator, equipped with special shaft with flexible coupling on one end and pulley on the other, direct-connected to one vertical cross-compound non-condensing engine with the necessary governor, which shall regulate within two per cent from no load to full load; one rheostat for the above; one voltmeter; one ammeter and one single throw switch with approved fuse blocks; all to be mounted on polished slate panel. The above to be guaranteed against defects in workmanship and materials for one year, price to be f.o.b. Plainfield, N. J. An alternate proposal on one 50-kw outfit is also requested. Further information will be furnished on application to the engineer.

CIMARRON, N. M.—The application of Charles Springer, of Cimarron, N. M., for 95 cu. ft.-second of water of the Rio Honde River in Taos County has been approved by the territorial engineer. The water will be utilized to develop 5000 hp. The development will involve an expenditure of about $200,000.

DEMING, N. M.—Word has just been received from B. P. Shull, who has been in Wichita, Kan., negotiating with the Western Construction Company for the installation of a large central power plant in Deming, stating that the deal for the power plant has been closed.

PORTALES, N. M.—The citizens have voted to issue bonds for the installation of lighting and sewer systems.

RATON, N. M.—The Van Houton Coal & Land Company is said to have placed contracts for the installation of an electric plant at Raton, which will furnish electricity for lamps and motors at the mines of the company located near the Gate City. The cost of the work is estimated at $35,000.

BROOKLYN, N. Y.—The Public Service Commission, First District, has approved the issue of $107,000 in bonds by the Coney Island & Brooklyn Railroad Company. The bonds are to be sold at not less than 80, the proceeds to be applied only to pay for betterments and improvements in carrying out reconstruction work in Franklin and DeKalb Avenues and relaying of its present rails in Smith Street, and paving of all three streets.

FORT H. G. WRIGHT, (P. O. NEW LONDON, CONN.) N. Y.—Bids will be received by the constructing quartermaster, U. S. A., New London, Conn., until Nov. 8, for furnishing and installing electric light fixtures and wattmeters in 10 buildings at Fort H. G. Wright.

HOOSICK FALLS, N. Y.—The Public Service Public Corporation has served an order on the Twin State Gas & Electric Company, a foreign corporation, with principal offices in Hartford, Conn., to show cause before the commission why it should do business in Hoosick Falls without permission of the commission. The company in August, 1908, acquired the plant and franchises of the Hoosick Falls Illuminating Company without asking the consent of the commission. An application of the

Twin State Company for permission to acquire the stock of the Hoosick Falls Company was previously denied by the commission on the ground that the new company was a foreign corporation.

JAMESTOWN, N. Y.—The municipal lighting commission has adopted a resolution recommending the purchase of the system of the Jamestown Lighting & Power Company for $90,000 and the appropriation of $30,000 for consolidating it under one roof with the municipal electric plant. The United Electric Securities Company, of Boston, Mass., owners of the plant, is said to have accepted the proposition. The commissioners will ask the City Council to call an election to vote on the proposition. The commissioners estimate that the consolidated plants will pay for themselves and realize a profit of $26,000 annually.

NEW YORK, N. Y.—The Fifth Avenue Association is having plans prepared for improving the illumination of Fifth Avenue, which will require the installation of additional lamps. W. M. Kendall, a member of the firm of Meade, Kendall & White, New York, N. Y., is preparing plans.

ONEONTA, N. Y.—The Otsego & Herkimer Railroad Company, successor to the Oneonta & Mohawk Valley Railroad Company, has applied to the Public Service Commission for permission to issue $1,500,000 in common capital stock; also to issue first, second and third mortgages and for authority to issue $500,000 in first mortgage bonds, $300,000 in second mortgage bonds and $700,000 in third mortgage bonds, the proceeds to be used to take over the property and franchises of the railroad acquired and to take up outstanding obligations. The railway connects Oneonta, Cooperstown, Richfield Springs, Mohawk, Herkimer and Utica.

TONAWANDA, N. Y.—Preparations are being made by the McKinnon Chain Company, of Buffalo, N. Y., recently incorporated to manufacture an electrically welded chain by a new process, for the construction of factory building 304 ft. x 80 ft. and a power house 30 ft. x 40 ft., both of steel and concrete construction, in Tonawanda. It is said that a large amount of special machinery will be required. Lachan E. McKinnon, president of the McKinnon Dash Company, of Buffalo, N. Y., who is inventor of the process, is president of the company.

WORCESTER, N. Y.—The Great Bear Light & Power Company has applied to the Public Service Commission, Second District, for permission to extend its transmission lines from East Worcester to Worcester for the purpose of furnishing electrical service in the last named place. There is at present an electric plant at Worcester operated by Henry Shafer, which is furnishing electricity in this village, but the service is not at all satisfactory.

ANSONVILLE, N. C.—Preparations are being made by A. H. Richardson for the construction of a hydroelectric power plant, which will include the construction of a steel reinforced concrete hollow dam 500 ft. long in main part and extreme length of 880 ft., 50 or 60 ft. in height; the power house will be located in hollow dam. The plans call for the development of from 6000 to 8000 hp for transmission. The cost of the entire plant is estimated at $750,000. Mr. Richardson also contemplates establishing cotton mills and other industries to utilize electricity for lighting and power. A. F. Lyman, of Lilesville, N. C., is engineer in charge.

ASHEVILLE, N. C.—An order has been made in Federal Court here by Judge J. C. Pritchard, confirming the sale of the property of the Rock Hill Water, Light & Power Company, of Rock Hill, S. C., by the receiver, P. A. Wilcox, of Florence, S. C., to Martin Maloney, at $80,000, and also the sale of the plant and holdings of the Carolina Water, Light & Power Company, of Darlington, S. C., by P. A. Wilcox, receiver, to Martin Maloney for $51,000, and the property of the Marion Light & Power Company, of Marion, S. C., by Mr. Wilcox to Mr. Maloney for $50,000, who was the highest bidder for the three properties.

CHAPEL HILL, N. C.—Extensive improvements are being made to the University power plant at Chapel Hill, N. C. The system has been changed from direct to alternating-current, 60 cycles. The old steam pumps in the city water works system are being replaced with motor-driven rotary pumps, and the central heating system is being enlarged. J. E. Latta, superintendent, designed the plant and has charge of the installation of the new apparatus.

CHARLOTTE, N. C.—The Cole Manufacturing Company has awarded a contract for the construction of a foundry and five other buildings, which will be equipped for the manufacture of farm implements. The plant, it is said, will be equipped for electric motor drive.

DURHAM, N. C.—The Durham Traction Company is contemplating increasing the output of its power plant and expects to place orders within a few weeks for a 500-hp Corliss cross-compound, condensing engine direct connected to a three-phase, 60-cycle, 2300-volt generator, or a 500-kw turbo-generator set. R. L. Lindsey is general manager.

MURPHY, N. C.—J. L. Smathers, of Murphy, N. C., is reported to be in the market for an electric light plant for a $50,000 hotel.

SALISBURY, N. C.—The Board of Aldermen has granted a franchise to parties interested in building an interurban electric line into the town from Concord, 23 miles south, the Salisbury franchise to become operative when ten miles of the interurban tracks towards Concord have been completed.

WARRENTON, N. C.—Preparations are being made by the Peck Manufacturing Company for the construction of its mill building 132 x 195 ft. The equipment will include 5000 spindles, boilers, turbines, electrical motors, etc., for manufacturing yarns. It is said that contracts have been made for all but the textile machinery. J. E. Sirrine, of Greenville, S. C., is the architect in charge and Thomas D. Peck, president.

CINCINNATI, OHIO.—Sealed bids will be received by the Director of Public Safety, Cincinnati, Ohio, until Oct. 29 for furnishing underground cable for the signal and telephone circuits for the Fire Department of the City of Cincinnati, according to the specifications on file in the office of the Director of Public Safety.

CUYAHOGA FALLS, OHIO.—The City Council has rescinded its former action in regard to the franchises of the Walsh Electric Light & Power Company and the Falls River Falls & Machine Company and has given both companies an extension of two years to commence work on their plants. Both companies were granted franchises two years ago to operate heat, light and power plants in Cayahoga Falls, work to begin within two years, but owing to litigation work was not commenced within the time. The Council has at former meetings refused to extend the franchises.

FREMONT, OHIO.—The capital stock of the Fremont Power & Light Company has been increased from $350,000 to $750,000.

LANCASTER, OHIO.—Application has been made to the City Council by the Lancaster Traction & Power Company for a franchise to construct a street railway on certain streets in Lancaster. Bids will be received for the franchise until Nov. 8.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Railway & Light Company has placed contracts for two 500-hp Heine boilers with the Heine Boiler Company, of St. Louis, Mo. M. E. McCaskey is general manager.

RYAN, OKLA.—The contract for the construction of water works system, electric light plant and sewer system in Ryan was awarded to N. S. Sherman & Company, of Oklahoma City, Okla.

BEAVER FALLS, PA.—The New Castle & Beaver Falls Valley Street Railway Company has petitioned the City Council for a franchise to construct and operate an electric railway in Beaver Falls. The company also contemplates the erection of a power plant in this city. The proposed railway will extend from Beaver Falls to New Castle. Robert W. Cunningham and Stewart S. Neff are interested in the project.

EASTON, PA.—The Stroudsburg & Water Gap Street Railway Company has petitioned the Town Council for a franchise to extend its railway to the borough limits. The company is planning to extend its railway from Easton to Portland.

HUNTINGTON, PA.—The Huntingdon, Lewiston & Juniata Valley Traction Company has filed record of a mortgage in the court house in Huntingdon for $1,500,000 in favor of the Empire Trust Company, of New York, N. Y. It is said that the company will commence construction work within 60 days.

McKEESPORT, PA.—The Pittsburgh, McKeesport & Westmoreland Railway Company has secured a franchise to construct and operate an electric railway between McKeesport and Westmoreland, a distance of 19 miles.

PHILADELPHIA, PA.—The Philadelphia & Reading Railway Company has awarded the contract for the construction of a power house in connection with the elevation of its Ninth Street tracks at Percy and Wallace Streets to Fred A. Havens & Company. The plant will furnish electricity for heat, lamps and motors to the adjacent yard and engine houses.

EASLEY, S. C.—It is reported that plans are being considered for establishing an electric light and ice plant in Easley, S. C. W. C. Cleveland, of Spartanburg, S. C., and others, are interested in the project.

GREENVILLE, S. C.—The Southern Power Company is erecting a substation near the city, through which electricity from Great Falls will be supplied to the Monoghan mills and the Woodside cotton mills and other mills about Greenville.

BELMONT, S. D.—The City Council is reported to be considering the question of establishing a municipal electric light plant.

GALLATIN, TENN.—Preliminary surveys have been made for the proposed electric railway from Gallatin to Beckwith, a distance of 12 miles. C. H. Fidler, of Gallatin, is said to be interested in the enterprise.

LIMESTONE, TENN.—Plans are being considered by Williams Brothers for the construction of a hydroelectric power plant in Limestone in the near future.

BRYAN, TEX.—It is reported that a bonus of $10,000 has been subscribed for the construction of an electric railway between Bryan and the State College, five miles in length. J. T. Maloney, Mayor, and others are interested in the project.

DALHART, TEX.—Preparations are being made by the Dalhart Ice & Electric Company to double the output of its plant, which will include the installation of a 250-hp generator and other equipment. The cost of the work is estimated at $10,000. S. E. Kellen is manager.

FORT WORTH, TEX.—It is reported that the citizens have voted to issue $25,000 in bonds, the proceeds to be used to extend the street lighting system.

FORT WORTH, TEX.—It is reported that the Fort Worth Mineral Wells & Western Railroad Company will submit a proposition to the Fort Worth Board of Trade asking for a bonus of $125,000, terminal site and right of way in Fort Worth. The citizens of Mineral Wells have accepted the proposition of the company to build its railway into Mineral

Wells for a bonus of $60,000, terminal site and right of way. L. C. Cole, of Fort Worth, Tex., is said to be interested in the project.

KINGSVILLE, TEX.—The Kingsville Ice Company, it is said, is contemplating the installation of an electric light plant. H. Delno is manager.

SALT LAKE CITY, UTAH.—The Utah & Nevada Telephone Company is extending its telephone line from Salt Lake City to Skull Valley, a distance of 75 miles.

MORRISVILLE, VT.—The citizens have voted to authorize the Water and Light Commissioners to enter into a contract with the Mount Mansfield Electric Railroad Company, of Stowe, Vt., to furnish energy to operate its railway, and to supply electricity to the village of Stowe for lamps at the rate of $30 per hp per year, with a minimum of $2,500 per year.

RICHMOND, VA.—It is reported that capitalists from Philadelphia contemplate building a double-tract electric line, at least 22 miles in length, to connect Colonial Beach with the Richmond, Fredericksburg & Potomac Railroad. It is said that Quantico, being the nearest railway station to Colonial Beach, will likely be the terminus of the electric line. The estimated cost of the work is about $250,000. The power plant will probably be located at Classic Shore. A further report has it that the Widener-Elkins street railway syndicate is behind this movement and that it is ultimately purposed to connect Richmond and Washington, D. C., by an electric line, several hundred miles in length. J. R. Benton, representing the parties interested, has already filed his petition for a franchise with the Town Council of Colonial Beach.

STANLEYTON, VA.—The contract for construction of an electric light plant has been awarded to P. H. Trout, of the Shenandoah Electric Company, of Staunton, Va.

PASCO, WASH.—The Walla Walla Valley Traction Company has filed a petition with the Superior Court asking for a franchise to construct its railway in the Riverside addition and on Ainsworth Avenue, and other sections outside the city limits. The company proposes to build an extension from Walla Walla to Pasco, surveys for which are being made.

SPOKANE, WASH.—The Crab Creek Telephone Company has applied to the County Commissioners for a franchise to erect a telephone line connecting Chattaroy, Milan and Deer Park and intervening farms.

SPOKANE, WASH.—Bids will be received until Nov. 5 by the Board of Public Works, Spokane, Wash., for the following equipment: Three 7,500,000-gal. multi-stage centrifugal pumps, three induction motors, switchboard and connections. Plans and specifications are on file in the office of Board of Public Works. George W. Armstrong is secretary of the board.

TRIADELPHIA, W. VA.—The Manufacturers' Heat & Light Company, of Pittsburgh, Pa., is reported to be contemplating the erection of a telephone line from Triadelphia to Majorsville, and is also considering building a line from Triadelphia across country to Fairmont, thence to Clarksburg and Lost Creek, W. Va. W. A. Jackson is superintendent.

ELKHORN, WIS.—Plans are being considered to enlarge the municipal electric light and water plant, which will include an addition to the power house, 24 x 40 ft., contracts for construction of which will soon be awarded.

MANITOWOC, WIS.—Contracts have been awarded by the Aluminum Foundry Company for the construction of a foundry and power house. The latter, it is said, will be equipped with gas engines, pumps and compressor.

MILWAUKEE, WIS.—Application has been made to the City Council by the Milwaukee Electric Railway & Light Company for a franchise to extend its railway over certain streets in Milwaukee.

PORTAGE, WIS.—The Chicago & Wisconsin Valley Railroad Company is said to be contemplating the construction of a steam turbine power plant, with rotary converter and transformer substations next spring. According to the present plans the generating units will be located at Portage. E. G. Frost, of Stevens Point, Wis., is president of the company.

RACINE, WIS.—The Belle City Malleable Iron Company has commenced work on the construction of a new building for its works and installation of a power plant, the equipment of which will include an engine-driven 200-kw generator and motors for operating machines; new blowers for furnaces will also be required;.

ST. JOSEPH, WIS.—The Moulton Rural Telephone Company has increased its capital stock from $3,600 to $6,000.

SUPERIOR, WIS.—The Great Northern Railway Company is reported to have awarded a contract to Schmidt Brothers & Hill for rebuilding one of its docks at Superior, which provides for all machinery to be operated by electricity.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company expects to place contracts within a few weeks for the construction of a 2¼-mile extension in North Vancouver, and a 7-mile suburban system extending east from Vancouver through Burnsby Municipality.

AYLMER, ONT., CAN.—We are informed that the municipal electric light plant, recently destroyed by an explosion, will be rebuilt. The cost of the work is estimated at $15,000. John L. Millard is engineer of the plant.

BRACEBRIDGE, ONT., CAN.—Bids will be received until Nov. 1, by Alex. Salmon, Town Clerk, for the construction of a hydroelectric plant as follows: (a) For construction of general works of the hydroelectric development of Wilson's Falls, Muskoka River, including dams, coffer dams, rock excavation, concrete walls, foundations, etc.; (b) Hydraulic machinery, including 1100-hp turbine, 35-hp turbine, governor, penstock, etc.; (c) Electrical machinery, including generator, exciter, switchboard, etc. C. H. & P. H. Mitchell, Traders' Bank Building, Toronto, Ont., are engineers.

CHIPPAWA, ONT., CAN.—Work has commenced on the construction of the first building of the Electrical Furnace Company in Chippawa. The building will be 180 ft. x 135 ft., and will cost about $80,000. The initial power unit will be 1,000 hp.

OWEN SOUND, ONT. CAN.—The City Council is reported to be considering a proposition submitted by the Georgian Bay Power Company to furnish electricity to operate the municipal electric lighting system. The company offers to supply 1500 hp at $20 per hp at the power plant at Eugenia Falls, or $24 per hp delivered in Owen Sound.

TORONTO, ONT., CAN.—Final contracts have been awarded by the Hydroelectric Commission in connection with the transmission lines, transformer stations and all mechanical equipment as follows: To Royce, Ltd., of Manchester, Eng., for electric cranes for the transformer stations at Niagara Falls and Dundas; for electric cranes for the transformer stations at Toronto, London, Guelph, Preston, Berlin, Stratford, St. Mary's Woodstock and St. Thomas, to Mussens, Ltd., of Montreal and Walkerville. The total amount of the tenders amounted to $17,094.

AYLMER, QUE., CAN.—The Hull Electric Company has placed a contract for a steel bulkhead at the power house at Deschenes.

POINTE AUX TREMBLES, QUE., CAN.—The Parish of Pointe aux Trembles has awarded an exclusive franchise to the Saraguay Electric & Water Company to furnish electricity for lamps and motors. The territory extends from Boute de Isle to Longue Pointe, covering about 35 miles on the Island of Montreal.

VERDUN, QUE., CAN.—Contracts have been awarded by the municipality for equipment in the municipal electric light plant as follows: For two engines to Laurie & Lamb, of Montreal, Que., agents for Beliss & Morcom, Birmingham, Eng., at $9,000; two 235-kva, three-phase, engine-type generators with direct-connected exciters and switchboards complete to the Canadian Westinghouse Company, for $7,532. Charles Brandeis, of Montreal, Que., is consulting engineer.

New Incorporations.

DE QUEEN, ARK.—Articles of incorporation have been filed for the De Queen Light & Ice Company with a capital stock of $50,000. The officers are: C. W. Dawley, president; P. G. Whaley, vice-president; Paul Coleman, secretary and treasurer.

COLUMBUS, GA.—The Chattahoochee River Power Company has been incorporated with a capital stock of $100,000 with the privilege of increasing it to $2,000.000. The company proposes to construct a large dam and power plant on the Chattahoochee River between Columbus and West Point. The dam will be 1000 ft. long and 30 ft. high; horizontal wheels direct-connected to electric generators will be installed. The cost of the initial plant including transmission lines, dam, etc., will be $400,000. J. E. Sirrine, of Greenville, S. C., is engineer in charge.

KITTERY, MAINE.—The Kittery Water & Electric Light Company has been incorporated with a capital stock of $100,000 and the following officers: J. S. Whittaker, of Portsmouth, N. H., president; S. W. Emery, of Boston, Mass., treasurer.

BUFFALO, MO.—The Big Naungua Power Company has been chartered with a capital stock of $490,000 by W. C. Clayton, Irvin Phillips, A. W. Martin, and others.

LAS CRUCES, N. M.—The Texas, New Mexico & Pacific Railway Company has filed articles of incorporation for the purpose of constructing a street railway from Mesilla to Sunny Slope, via Las Cruces, three miles in length. The company is capitalized at $50,000, and the incorporators are: James T. Smith, Edward Ehle, Charles K. Atkinson, Allen J. Papen and Frank A. Jones, all of Las Cruces.

COLUMBUS, OHIO.—The Columbus & Cincinnati Air Line Traction Company has been chartered to construct an electric railway from Columbus and Cincinnati, via Washington, C. H., and Wilmington. The incorporators are: Frank E. Ruth, E. B. Tompkins, Randolph W. Walton, W. L. McVey and M. B. Recob. The company is capitalized at $10,000.

BEDFORD, PA.—Articles of incorporation have been filed for the Bedford, Fulton & Franklin Street Railway Company to construct an electric railway through Bedford, Fulton and Franklin counties, connecting Bedford and Chambersburg, 50 miles in length. The capital stock is placed at $300,000. The incorporators are: M. J. Murphy, of Pittsburgh, president; H. D. Tate, George W. Rook, John B. Fay, M. H. Sheats and J. Y. Daly.

BELLEFONTE, PA.—The Center County Traction Company has been incorporated with a capital stock of $100,000 to construct an electric railway from Bellefonte to State College, a distance of 15 miles. The incorporators are: W. C. Hagan, of Pittsburgh, president; William H. Furey and L. T. Munson.

JONESBORO, TENN.—The Markwood Power Developing Company has filed articles of incorporation with a capital stock of $20,000. The incorporators are: A. T. Markwood, C. E. Burchfield, W. H. Martin, and others.

BAY CITY, TEX.—The Gravity Irrigation & Power Company has been incorporated with a capital stock of $500,000 by Clinton S. Woolfolk and Henry S. Judson.

DALLAS, TEX.—Articles of incorporation have been filed for General Electric Company with a capital stock of $50,000 by B. E. Sunny, H. L. Monroe and Keames W. Johnson, all of Chicago, Ill., and James F. Strickland.

MANSFIELD, WASH.—Articles of incorporation have been filed for the Mansfield Water & Light Company with a capital stock of $5,000 by J. W. Wright and others.

SPOKANE, WASH.—The Idaho Central Railway, of Spokane, has been incorporated with a capital stock of $25,000 by A. Morgan and J. A. Rea.

SPOKANE, WASH.—Articles of incorporation have been filed for the Kettle River Water Power Company by E. L. Tate, R. L. Thompson, Reese Voorhees, Charles Grant and W. W. McCreary. The company is capitalized at $25,000.

MADISON, WIS.—Articles of incorporation have been filed for the Chicago & Wisconsin Valley Railroad Company for the purpose of constructing an electric railway from Janesville to Merrill, via Stoughton, Madison and other towns. The company is capitalized at $40,000, which will be increased later to build and equip the road. The officers of the company are: D. E. Frost, of Stevens Point, president; J. W. Purvis, of Friendship, vice-president; A. J. Behymer, of Indianapolis, Ind., secretary; A. J. Baskerville, of Madison, assistant treasurer, and Allen T. Russell, of Baltimore, Md., general and chief engineer. The contract to construct and equip the railway, it is said, will be let to the Western Indian Construction Company, which will open an office at Madison or Portage.

NELSON, B. C., CAN.—The Nelson Street Railway Company has been chartered with a capital stock of $50,000 for the purpose of acquiring from the city the present tramway and appliances. It is said that the company will make extensions to same.

Personal.

MR. L. B. MARKS has been appointed a member of the committee on gas and electricity of the Merchants' Association of New York.

MR. T. C. RYAN, of the Cincinnati office of the Ft. Wayne Electric Co., addressed the Electro-Technic Club of Ft. Wayne on Oct. 19, the subject being "Salesmanship."

MR. WALTER D'ARCY RYAN, of the General Electric Company, was married Oct. 23 to Miss Katharine Flora Haskins at the home of the bride at North Adams, Mass.

PROF. H. H. NORRIS, head of the department of electrical engineering at Cornell University, has been elected secretary of the Society for the Promotion of Engineering Education.

MR. N. J. NEALL will present a paper on "High Voltage Transmission and Lightning Protection" at a meeting of the Worcester Polytechnic Institute A. I. E. Branch on Nov. 19.

MR. GUY H. GIBBS, who has been with the Westinghouse Electric & Manufacturing Company for the past eight years, four of which have been with that company's Cincinnati office, now represents the Western Electric Company at Cincinnati.

MR. H. J. PLAGGE has been appointed instructor in the department of physics and illumination, of the Iowa State College. Mr. Plagge has the degree of B.S. from Northwestern University, and has passed two years in graduate work and as instructor in physics at the University of Wisconsin.

MR. W. A. BEVAN has received the appointment as instructor in the department of physics and engineering of Iowa State University, his alma mater. Mr. Bevan has taken a graduate course at Chicago University and resigned as principal of the Cavite, P. I., Trade School to accept the present position.

MR. MATHEW C. BRUSH has resigned as general manager of the Boston Suburban Electric Company to assume the same position with the Buffalo & Lake Erie Traction Company, and Jamestown, Chataqua & Lake Erie Railway. These lines control 200 miles of electric railway, 50 miles of steam road and a fleet of steamboats.

MR. M. C. TURPIN, formerly superintendent of the Auburn (N. Y.) Light, Heat & Power Company, and more recently electrical engineer on the engineering staff of the Public Service Commission of the First District, New York City, has severed his connection with the commission and has accepted a position with the Westinghouse Company at East Pittsburgh.

MR. R. F. HAYWARD, formerly manager of the Mexican Light & Power Company, and before that chief engineer of the Utah Light & Power Company, has resigned his position to take a similar one with the Vancouver Light & Power Company. Mr. Hayward takes with him Fred D. Nims, who has been chief engineer in Mexico, and who will now be associated with the Vancouver company.

MR. EDWARD L. BAILEY, of the Dundee (N. Y.) Electric Lighting Plant, is planning to spend the winter with his family in Florida. He heretofore spent his winters in New York and Philadelphia doing engineering work for some of the large electrical construction companies. Prior to his connection with the Dundee plant Mr. Bailey was purchasing agent for the American Gas & Electric Company, of Philadelphia.

MR. C. A. FELKER, has been appointed superintendent of the New Sigourney Electric Light & Power Company, which recently purchased the central station property at Sigourney, Iowa. The old power house and station will be abandoned and a new alternating-current plant built. Mr. Felker has been connected with the electrical industry the past 20 years, at one time having been superintendent of construction and motive power with the Freeport (Ill.) Light & Railway Company, and later sales manager of the Central Electric Company, Chicago.

MR. GEORGE McKINLEY MATTIS, of Champaign, Ill., vice-president and treasurer of the Illinois Traction System, was married to Miss Elsie Evans Curtis, daughter of Mr. and Mrs. William E. Curtis, of Washington, D. C., in the latter city on Oct. 16. Mr. Mattis is a nephew of Hon. William D. McKinley, representative in Congress from Illinois, and president of the Illinois Traction System. Mr. Mattis comes from an old American family. His great-grandfather, the Rev. Robert Finley, was the founder of the American Colonization Society, under whose auspices the republic of Liberia was organized.

MR. ARBA B. MARVIN has opened an office in the Commercial National Bank Building, Chicago, for the practice of patent law. Mr. Marvin, who is an electrical engineering graduate of the University of Wisconsin, has served in the testing department of the General Electric Company, Schenectady, for a time was instructor in electrochemistry at the University of Wisconsin, and has made a specialty of electrochemistry and electrometallurgy. He studied law at the Columbian University, Washington, while an examiner in the U. S. Patent Office, and for the past five years has been an assistant attorney in the General Electric patent department.

MR. R. M. SEARLE, of the Rochester Railway & Light Company, was the chairman of the committee to whom much of the success of the recent industrial exposition in Rochester is due. In booming Rochester, Mr. Searle feels that he is adding to the income of his company which owns the railway, gas and electric light plants; for prosperity cannot come to Rochester without his company reaping a share of it. Mr. Searle was formerly connected with the Westchester Lighting Company and also with the Georgia Railway & Electric Company. Last January he was promoted from general manager to third vice-president of the Rochester company in recognition of meritorious service.

MR. C. W. HOUGH has been appointed general manager of the Consolidated Power & Light Company of Deadwood and Lead, South Dakota. Mr. Hough has for three years past been manager of the Consolidated Light, Power & Ice Company of Joplin, Mo., where his experience in building up a load among the lead and zinc mines of that district fits him especially for his new work. The company of which he has just assumed the management, supplies electric power to the gold mines of the Deadwood district and also lights the various towns. The company has a modern steam turbine plant and excellent opportunities for development. The president of the company is Mr. N. E. Franklin, a prominent citizen and capitalist of Deadwood, and eastern capital is also largely interested. Previous to his Joplin experience Mr. Hough was for seven years with the General Electric Company in various engineering and business capacities. His analysis of the Doherty "Readiness to Serve" rate, presented at the last Missouri convention and printed in these pages, attracted much attention among central-station men.

Obituary.

MRS. GARDINER GREEN HUBBARD, widow of the first president of the American Bell Telephone Company, and mother of the wife of Alexander Graham Bell, was thrown fram her automobile in Washington on Oct. 20 as the result of a collision with a trolley car, and died not long afterward. Mrs. Hubbard was 84 years old. She was a wealthy woman, and for many years was a leader in philanthrophic work in Washington.

Trade Publications.

DESK LAMPS, of neat and attractive appearance, are listed, described and illustrated in a leaflet issued by H. G. McFaddin & Company, 38 Warren Street, New York.

ENGINES.—Vertical-cylinder steam engines designed with particular reference to silent operation are treated in a mailing folder issued by the American Blower Company, Detroit, Mich.

LIGHTING SPECIALTIES, including snaplock sockets, fixture wrenches, and grips for incandescent lamps, are treated in leaflets issued by the Yost Electric Manufacturing Company, Toledo, Ohio.

ELECTROLYTIC RECTIFIERS, for 110-volt circuits and for currents ranging from 2 amp to 30 amp are fully described and illustrated in a catalog of the Como Electrical Company, Spring Lake, N. J.

DRILLS.—The Cleveland Twist Drill Company, Cleveland, Ohio, has issued a folder devoted to drills with flat taper shanks. These drills are twisted from a flat bar instead of being milled from round stock.

ACID-PROOF VALVES.—The Cleveland Bronze & Brass Works, Cleveland, Ohio, has issued a neatly executed catalogue describing valves designed for withstanding the influence of sulphuric acid and other corrosive liquids.

GAS ENGINES of the single-cylinder type, rated at from 20 to 100-hp, and of the tandem type, rated at from 50 to 500-hp, are illustrated and briefly described in a folder issued by the Bogart Gas Power Engineering Company, Buffalo, N. Y.

VACUUM CLEANERS.—A motor-driven 3-hp vacuum cleaning outfit is described in detail in a pamphlet issued by the Spencer Turbine Cleaner Company, Hartford, Conn. A separate publication gives an imposing list of cleaner installations now in service.

GAS PRODUCERS.—Bulletin No. 4 of the Hill-Hupfel Engineering Company, 30 Church Street, New York, gives much specific information relating to producer gas plants designed to use anthracite fuel. Brief mention is made also of plants for using bituminous coal, lignite or peat.

COPPER-CLAD STEEL WIRE.—The Duplex Metals Company, 149 Broadway, New York, has issued a well-prepared catalog dealing with its copper-clad steel wire. This wire is 60 per cent as strong as steel and has a conductivity of 40 per cent of that of a copper wire of the same size. Many railroads use this wire for signal circuits.

SUCTION CONVEYORS.—The Darley Engineering Company, Singer Building, New York, has issued bulletin No. 4. devoted to suction conveyors for coal and ashes. The bulletin contains a list of suction conveyor plants in operation or being constructed. A special leaflet issued by the company contains a large number of letters of endorsement from satisfied customers.

SPEED REGULATORS, for use with electric motors operating blowers of mechanical stokers, boiler feed pumps, gas pressure blowers, etc., are well treated in a pamphlet issued by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The regulators are of the pressure-controlled type and can be employed with direct-current, single-phase repulsion or polyphase induction motors.

BOILER-TUBE CLEANERS.—The Lagonda Manufacturing Company, Springfield, Ohio, has issued a 48-page booklet describing Weinland boiler-tube cleaners. Full descriptions are given of the various types of cleaners manufactured by this company and of the scale conditions for which each is best suited is pointed out. Among the new types developed are the air-driven and steam-driven turbine, and also a line of cleaners for use in condenser and economizer tubes.

EXIDE SPARKING BATTERY.—The Electric Storage Battery Company, of Philadelphia, has recently issued an attractive publication on the "Exide Sparking Battery," which contains a very complete description of its well-known ignition cell and a rather unusual double-page illustration showing its entire construction at a glance. In addition to this description of the battery, three timely articles have been specially written for this publication by the editors of *Motor, Cycle and Auto Trade Journal* and *Automobile*, which touch upon such subjects as spark plugs, care of the automobile, etc.

Business Notes.

GENERAL ELECTRIC A.-Y.-P. GRAND PRIZE. The Alaska-Yukon-Pacific Exposition has awarded to the General Electric Company a grand prize on its general exhibit of electrical apparatus and completely furnished model apartment.

ICE MAKING AND REFRIGERATING MACHINERY.—A list of recent sales of ice making and refrigerating machinery of the York Manufacturing Company, York, Pa., includes more than two score plants from almost half that number of States.

ROEBLING A.-Y.-P. PRIZES.—The John A. Roebling's Sons Company has received 10 grand prizes, the highest awards, for its exhibit at the Alaska-Yukon-Pacific Exposition. A grand prize was awarded the company for its general exhibit and similar prizes were bestowed for different articles shown. Among the Roebling products thus recognized were iron telephone and telegraph wire, steel, brass and copper wire, and insulated wires and cables.

FRINK REFLECTORS.—The tower of the Metropolitan Life Insurance Building in New York City, which is the highest building in the world, is lighted by special reflectors placed there by the firm of I. P. Frink, 551 Pearl Street, New York. By their means the clock dials are rendered distinct and impressive, and the lantern at the extreme top, which is over 7 ft. in diameter, has the appearance of one mass of fire. It indicates the hours by flashes of white light. while red flashes indicate the quarter hours—one for one-quarter past the hour, two for one-half past the hour, three for three-quarters past the hour. I. P. Frink has just been awarded the grand prize for reflectors by the Alaska-Yukon-Pacific Exposition.

HALLER SIGNS.—The Haller Signs Works, Chicago, report the following recent installations of electric roof signs with spectacular display features: Krug Brewing Company, Omaha, Neb. (beerglass with overflowing foam effect); Brandeis & Sons (clothiers), large man with elaborate moving and whirling scroll border; Boston Drug Company, Kansas City, Mo., figure of man with lightning stroke effects; Gayety Theater, Minneapolis, Minn., dancing girl; Upmann & Wilcox, Cleveland, Ohio, and Columbus, Ohio, two lamp letter sign with large cigars and rising smoke effect; new Cort Theater, Chicago, house sign and attraction board with moving scroll border and kaleidoscopic top piece; new Cort Theater, Chicago, imitation fireworks display for finale of first act of "The Kissing Girl;'" The Ritter Company, Spokane, Wash., large sign with double whirling border effect.

THE IDEAL ELECTRICAL & MANUFACTURING COMPANY, Mansfield, Ohio, reports that it has taken contracts within the past thirty days for motors aggregating several thousand horse-power. It has also received orders for two 250-kw belted alternators for the Buckeye Mining & Smelting Company, Big Pine, Cal.; one 75-kw alternator for Clay Center, Neb.; one 75-kw alternator for the Turnbull Manufacturing Company, Toronto, Can.; nine 15-hp slip-ring alternating-current motors for elevators in the E. M. F. automobile factory at Detroit, Mich.; fifteen squirrel-cage motors for the M. C. Peters Mill Company, Omaha, Neb., sizes 3 to 60-hp; individual motor drive in a new mill of the Mansfield Elastic Web Company, consisting of seventy motors for individual drive on elastic web looms; three 400-amp, alternating-current motor driven low-voltage generators for electro-plating service; one 2500-amp plating dynamo, and two 1500-amp. plating dynamos. The factory is being run fifteen hours per day at the present time.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT., 19, 1909.

[Conducted by W. F. Bissing, Patent Law, 2 Rector Street., N. Y. City.]

937,050. TELEPHONE SYSTEM; H. P. Clausen, Chicago, Ill. App. filed June 4, 1908. Central energy system with test circuits with a supervisory relay in the cord circuit with an induction coil having a tertiary winding with means for establishing a busy test through said relay and winding.

937,052. TERMINAL CONNECTOR CONSTRUCTION; C. Cuno, Meriden, Conn. App. filed Feb. 10, 1909. Connector for spark plugs having a clip and handle with a screw passing through a bored passage for the wire end.

937,062. THERMAL PROTECTOR; S. B. Fowler, La Fayette, Ind. App. filed May 23, 1907. For telephone systems to avoid resoldering consisting of a metallic flanged cylinder and a pair of insulating disks secured to the head of the cylinder.

937,074. ELECTRICAL HEATING METHOD; W. McA. Johnson, Iola, Kan. App. filed Jan. 11, 1904. A furnace in which a granular material of high resistance is fed between the charge and the wall of the furnace to avoid heat losses.

937,075. COUPLING FOR TROLLEY WIRES; J. W. Kline, Terre Haute, Ind. App. filed Dec. 26, 1908. A narrow plate having two passages at an angle to the length of the plate for receiving the ends of the wire sections with set screws for holding them.

937,098. MERCURY CONTACT RELAY; C. F. A. Schuldt and F. H. Nicholson, St. Paul, Minn. App. filed Oct. 12, 1908. For railway signals. A glass container surrounds magnetically operated contacts and a magnet outside of the glass operates them.

937,107. OVERHEAD ELECTRIC CONTACT; T. W. Small, Cleveland, Ohio. App. filed June 26, 1908. For trolleys. To operate a street indicator in the car. A block in the line of travel of the trolley wheel carries metal bristles with which the wheel contacts.

937,119. PROCESS OF PRODUCING SILICON CARBID; F. J. Tone, Niagara Falls, N. Y. App. filed Apr. 1, 1908. For smoking silicon carbide in an arc furnace, the arc zone being moved into the direction of the unreduced mixture.

937,120. METHOD OF REDUCING METALLIC COMPOUNDS; F. J. Tone, Niagara Falls, N. Y. App. filed June 24, 1908. Supports the charge with a reducing agent on a hearth which is pervious to the reaction products but impervious to the charge.

937,128. METHOD OF OXIDIZING METALS DISSOLVED IN MERCURY; J. Whiting, Boston, Mass., and C. F. Burgess, Madison, Wis. App. filed Dec. 16, 1908. Electrolyses alkali metals by providing carbon surfaces exposed to an oxidizing electrolyte and a moving body of amalgam, the circuit being made through a quiet body of mercury.

937,130. GROUND PIPE CAP; P. F. Williams, Chicago, Ill. App. filed Apr. 15, 1908. For ground pipes for overhead wire poles. The ground wire is clamped between the pipe and cap.

937,134. ADJUSTING MECHANISM; A. H. Wouters, Norwood, Ohio. App. filed Dec. 31, 1906. For forming wedge shaped coils by a rotary frame with means for intermittently moving the supports of the coils.

937,140. NON-DETACHABLE INSULATOR; H. Bartlet and A. P. MacCallum, Albuquerque, New Mex. App. filed May 12, 1908. For connecting the insulator to its supporting pin by an interlock.

937,189. TELEPHONE REPEATING SYSTEM; H. E. Shreeve, Wyoming, N. J. App. filed Aug. 21, 1908. Utilizes an induction coil with a plurality of cores and with line and repeater windings, one winding common to a plurality of cores.

937,201. CURRENT CONTROLLER; F. Andrew, Cincinnati, Ohio. App. filed Apr. 27, 1908. Positive stoppage of the controller arm occurs at each contact between the movements.

937,210. PROCESS OF PREPARING POTABLE WATERS; J. T. Harris, New York, N. Y. App. filed Nov. 20, 1906. Electrolyses water in contact with anodes of iron and aluminum with an electrode of copper thus producing chemicals which precipitate the impurities.

937,229. PUFF IRON; J. W. Cook, Omaha, Neb. App. filed Feb. 16, 1909. Flat iron for shoulder puffs of irregular contour mounted on a supporting standard with an egg shaped head.

937,242. AUTOMATIC CIRCUIT-BREAKER; N. H. Holland, Brookline, Mass. App. filed Oct. 22, 1904. A sliding member is released by expansion to control the circuit.

937,277. BLOW PIPE FOR CALCINING INCANDESCENT FILAMENTS; G. Auger, Paris, France. App. filed May 2, 1908. A press with an annular burner through the center of which the filament passes.

937,281. SPACE TELEGRAPHY; S. Cabot, Brookline, Mass. App. filed Dec. 31, 1906. A multiple series spark gap with a rotating member.

937,282. SPACE TELEGRAPHY; S. Cabot, Brookline, Mass. App. filed Dec. 31, 1906. A multiple series spark gap and means for including any desired number of the electrodes in circuit.

937,291. RESILIENT DRIVING CONNECTION; G. M. Eaton, Wilkinsburg, Pa. App. filed Jan. 11, 1909. A floating ring and springs connected therewith.

937,324. ELECTRIC BATTERY; M. Nicolas, Paris, France. App. filed Feb. 21, 1907. A cylinder of carbon, a series of zinc washers around it and a series of felt washers.

937,326. FUSE MOUNTING FOR ELECTRIC CUT-OUTS; W. J. Patnode, Providence, R. I. App. filed Nov. 20, 1908. Contained in a case with clip ends so as to be readily detachable when the fuse is to be replaced.

937,328. COIL FORMING MACHINE; W. D. Pomeroy, Norwood, Ohio. App. filed Dec. 31, 1906. For making wedge shaped coils. A rotatable frame with means for varying the distance between the coil supports automatically as the frame rotates.

937,332. THERMIC CONTROLLER; E. H. Richardson, Ontario, Cal. App. filed May 14, 1908. For flat irons, etc., in which a moving element is anchored in a material when the latter is hard, but moves when the material softens under heat.

937,342. ELECTRIC CEILING FIXTURE; A. G. Walin, Seattle, Wash. App. filed Mar. 8, 1909. A hollow wall plate for electric lamps. Details.

937,377. APPARATUS FOR PREVENTING COLLISIONS ON RAILWAYS; T. C. Mason, Los Angeles, Cal. App. filed Feb. 24, 1908. Current producer on the train closes the throttle valve of both locomotives when they approach too near.

937,386. ARC LAMP; R. H. Pyle, Indianapolis, Ind. App. filed Oct. 9, 1907. An arc lamp with clutch ring and ball.. Details.

937,387. PROCESS OF RECOVERING PRECIOUS METALS; J. H. Reid, Newark, N. J. App. filed Feb. 3, 1909. Ore is ground, mixed with a flux and then treated to several electric arcs, the volatilized portion being withdrawn by gas suction.

937,393. ELECTRIC FLUID PRESSURE BRAKE; W. V. Turner, Wilkinsburg, Pa. and R. H. Blackall, Edgewood Park, Pa. App. filed Feb. 24, 1904. Additional electrically operated valve devices to control the brake so that the brake is operated either electrically, pneumatically or vented automatically.

937,396. SMALL ARM; W. Venier, Klosterneuburg-Weidling, Austria-Hungary. App. filed Jan. 11, 1907. Hammerless gun with several barrels discharged electrically.

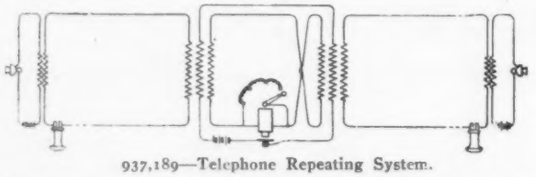
937,399. FOUR PARTY TELEPHONE LINE; K. Weman, Buffalo, N. Y. App. filed Jan. 23, 1906. Each subscriber's station includes a signal, condenser and retardation coil so arranged as to balance the line.

937,407. STEM FOR CHANDELIERS; G. M. Beardslee, Chicago, Ill. App. filed July 30, 1908. A hollow shell in two separable parts formed externally like a chain.

937,427. ROSETTE; F. C. De Reamer, Schenectady, N. Y. App. filed July 3, 1909. A base, body and cap with flat terminal and contact plates.

937,429. MEANS FOR COOLING DYNAMO ELECTRIC MACHINES; W. L. R. Emmet, Schenectady, N. Y. App. filed Aug. 19, 1905. For vertical generators. Uses a fan rotating with the armature inside of a hood.

937,435. FLEXIBLE CABLE FOR LAMPS; E. J. Guay, Lynn, Mass. App. filed Sept. 12, 1908. Beads of porcelain strung in the cable, insulate it.



937,189—Telephone Repeating System.

937,438. DEVICE FOR THE PREVENTION OF RAILWAY ACCIDENTS; R. Hauser, Oberstein-on-the-Nahe, Germany. App. filed Mar. 5, 1909. Stops the train when a signal is overlooked by actuating the air brake.

937,439. BLOCK SIGNAL SYSTEM; L. A. Hawkins, Schenectady, N. Y. App. filed Mar. 18, 1909. Alternating-current system in which a single track circuit controls a plurality of different signal operations. Uses a track relay operated through the rails and a second track relay in shunt to a short length of track. The two relays are in different control circuits.

937,440. BLOCK SIGNAL SYSTEM; L. A. Hawkins, Schenectady, N. Y. App. filed Apr. 23, 1909. Alternating current signal system with continuous rail paving A.C. sources across the rails, track relays and a resistance coil.

937,442. CIRCUIT CONTROLLING DEVICE; E. Johnson, Schenectady, N. Y. App. filed Apr. 13, 1906. A switch, circuit breaker and stationary abutment with actuating toggle for the switch and one for the circuit breaker and a handle rigidly connected to the first toggle and through a lost motion, with the breaker toggle.

937,447. INSULATOR; M. T. A. Kubierschky and P. E. Herkner, Berlin, Germany. App. filed Oct. 19, 1904. Suspension insulator having a metal screw threaded shell, an insulated bolt and an independent insulator surrounding the bolt.

937,451. MOTOR CONTROL APPARATUS; W. O. Lum, Schenectady, N. Y. App. filed July 26, 1906. A plurality of electrically controlled switches, two circuits for actuating alternate switches and a two position relay for automatically causing temporary energizing of said circuits alternately.

937,462. DYNAMO ELECTRIC MACHINE; J. E. Noeggerath, Schenectady, N. Y. App. filed June 1, 1908. Collector ring for low voltage unipolor dynamo, a plurality of rings forming a set formed of a single casting. Also uses a magnetic ring surrounding armature to balance end thrust.

937,463. MEANS FOR ATTACHING INSULATING LININGS; C. D. Platt, Bridgeport, Conn. App. filed Sept. 26, 1908. Removable insulating lining for lamp sockets.

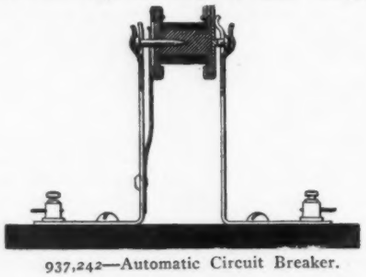
937,469. SYSTEM OF VOLTAGE REGULATION; P. Rose, Berlin, Germany. App. filed May 27, 1909. For automatically distributing the load of separately excited generators running in parallel, whose excitation is controlled by automatic potential regulator.

937,486. PROCESS OF PRODUCING STEEL FREE FROM PROTOXIDS; Otto Thallner, Bismarkhutte, Germany. App. filed April 20, 1909. Blows the steel and passes it to a basic electric furnace and adds silicon.

937,495. TROLLEY GUARD; S. G. Wilcox, North Adams, Mass. App. filed Nov. 18, 1908. A spring pressed sliding plate normally extending above the wheel and over the wire which passes the hangers and may be withdrawn by the operator when pulling down the pole.

937,515. INSULATOR PIN; C. J. Dorff, Chicago, Ill. App. filed Feb. 3, 1909. A hollow screw with slots to make it compressible.

937,581. TELPHERAGE SYSTEM; O. J. Davy and C. W. Dauber, Washington, D. C. App. filed Dec. 21, 1906. Independent motors



937,242—Automatic Circuit Breaker.

in the carriages which run on a cable that also conducts the current. Avoids separation of the trolley from the cable.

937,586. STORAGE BATTERY; L. H. Flanders, Wilkinsburg, Pa. App. filed Aug. 6, 1904. A connecting plate for the electrodes of like polarity having a flexible terminal log with a highly conducting core.

937,590. ELECTROMAGNETIC MEANS FOR OPERATING AIR AND OTHER WHISTLES; H. H. Freeman, St. Paul, Minn. App. filed Aug. 24, 1908. A double chambered valve casing separated by a diaphragm which operates a valve and is operated by an electromagnet.

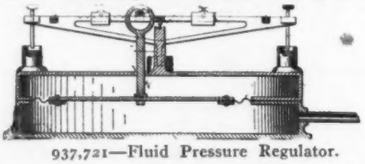
937,594. ELECTRIC BELL; E. A. Graham, Brockley, England. App. filed Feb. 2, 1909. For protecting against moisture having a hollow electromagnetic winding with a vertical axis enclosed in watertight casing and a non-corrodible striker.

937,617. ALTERNATING CURRENT CONTROLLING MEANS; D. L. Lindquist, Yonkers, N. Y. App. filed June 21, 1905. For changing the line voltage and for starting an induction motor by single-phase current. Uses a parallelogram bridge of inductances and resistances with a transformer and motor.

937,634. ALTERNATING CURRENT ELECTROMAGNETIC VALVE APPARATUS; F. W. Newell, Philadelphia, Pa. App. filed Apr. 2, 1907. For an alternating current elevator system using a main valve, a pilot valve connected between them and a multi-phase magnet for actuating the connections.

937,675. INDUCTOR DYNAMO; G. A. Colman, Seattle, Wash. App. filed Dec. 31, 1908. A high-speed rotor consisting of a smooth disk of solid metal and heterogeneous as to magnetism.

937,691. STATIC INDUCTION GENERATOR; B. E. Baker, Hartford, Conn. App. filed Nov. 6, 1905. A plate for static machines consisting of an insulating disk of layers of mica and a binding



937,721—Fluid Pressure Regulator.

material covered with fibrous material impregnated with an oxidizing oil.

937,709. SWITCH; H. N. Motsinger, Pendleton, Ind. App. filed Mar. 28, 1908. For connecting a generator, a storage battery and a service line so that the latter may be served from the generator or battery or the battery charged from the generator. Includes a block with three pockets containing terminals and a switch pin.

937,721. FLUID PRESSURE REGULATOR; E. Schulte, Hamm, Westphalia, Germany. App. filed Nov. 29, 1907. For controlling blowers by means of a diaphragm in a closed chamber and three cups full of a conducting liquid with a balancing beam operated by change in gas pressure to control the circuits.

937,730. BATTERY ELECTRODE; G. A. Wedekind and H. P. L. Poerscke, Hamburg, Germany. App. filed June 19, 1905. A rigid plate with projecting lugs and a layer of electrolytic, spongy copper held on the face by the lugs coated with copper oxid.

937,736. INSULATOR; P. S. Dumbolton and F. Franz, Burke, Idaho. App. filed Nov. 21, 1908. Has a conical socket with a spiral groove which engages a spiral spring around the pin which carries the insulator.

937,737. BLOCK SIGNAL SYSTEM; L. A. Hawkins, Schenectady, N. Y. App. filed Mar. 11, 1909. Both rails are continuous and control a block signal system by a.c. current sources connected at intervals therewith, the currents from adjacent sources differing in character and operating relays.

837,738. BLOCK SIGNAL SYSTEM; L. A. Hawkins, Schenectady, N. Y. App. filed June 10, 1907. Both rails are continuous with a.c. current connected thereto at intervals, the adjacent currents differing in character, and controlling relays.